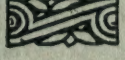


PAGE'S WEEKLY



ENGINEERING · ELECTRICITY
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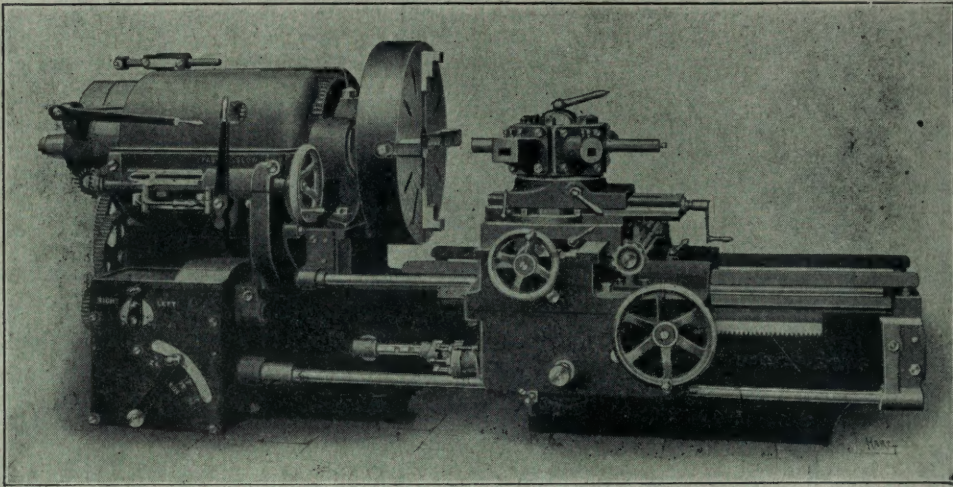
FRANCE, Paris : 22, Rue de la Banque.
GERMANY, Berlin : 13, Unter den Linden.
RUSSIA, St. Petersburg : 14, Nevsky Prospect.
ITALY, Rome : 307 Corso.
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With the Lathe illustrated here the spindle speed increases automatically as the tool travels towards the centre. Herein is the Perfection of Speeds, as at whatever diameter the tool begins to cut the correct speed may be used.



If you are doing Surfacing work on Lathes, you must investigate LANG'S PATENT VARIABLE SPEED DRIVE. We can now machine a surface in half the time you can.

DOES THIS FACT INTEREST YOU?

No COUNTER MOTION REQUIRED

with these Lathes.

VISITORS WELCOME.

JOHN LANG & SONS,

Johnstone, near Glasgow.

PAGE'S WEEKLY

Miscellaneous

Mr. G. H. HUGHES, M.I.Mech.E.,

Consulting and Organising Engineer for Water Works and Industrial Undertakings,

97, QUEEN VICTORIA ST., LONDON, E.C.

Telephone No.: 5754 Bank.

Write for particulars

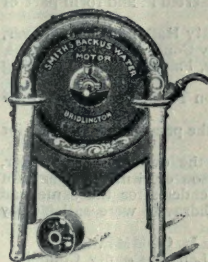
ED. BRAND, MECHANICAL ENGINEER, 35, SHAKESPEARE STREET, MANCHESTER.

Modern Wire-Working Machinery,

Such as for Rolling, Drawing, Weaving, Netting, Forming, Automatic Straightening and Cutting, Cabling, Testing, &c.

Inquiries Solicited.

Teleg. Address: "Filières, Manchester."



CHEAP POWER.

SMITH'S

Backus Water Motors

1/16 to 10 H.P.

Will drive any class of Machinery, and work on 15 lb. pressure.

ERIC S. A. SMITH, ENGINEER,
APPLY FOR CATALOGUE. **BRIDLINGTON.**

Second Edition, Revised. Price 7s. 6d.

DEPRECIATION OF FACTORIES, Mines, and Industrial Undertakings, and their Valuation. With Tables and Examples.

By EWING MATHESON, M.Inst.C.E.

The Principles which should guide the Writing off for wear and tear, Obsolete plant; Terminable or wasting properties; Effect on Income-tax; Value defined as for Compulsory purchase; Going concern, or dismantled; Rateable value, rental value.

"A successful attempt to systematise existing information and to make it possible to arrive at uniformity and accuracy in making up balance sheets for valuations. The work is unique of its kind."—*The Engineer*.

E. & F. N. SPON, 125, Strand, London.

JOSEPH BOOTH BROS., LTD.,
RODLEY, LEEDS.

LIFTING MACHINERY.

THOS. W. WARD,
ALBION WORKS,
SHEFFIELD.

See Page
20.

MACHINE TOOLS.

THE SHANNON, LTD.,
Ropemaker St., London, E.C.

See Page
87.

OFFICE APPLIANCES

Have you seen our Advertisement on page 57. A glance at it may save you £500 per annum.—

ED. BENNIS & CO., Ltd., BOLTON.

"UNICA" SILENT GEARS

Equal in STRENGTH to, and MORE DURABLE than Cast Iron, Gun Metal, or Rawhide.

NO SIDE PLATES OR BUSHES! UNAFFECTED BY OIL!
Have stood test of four years.

J. B. HAMILTON & CO.,

Telegrams:
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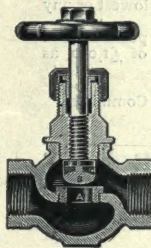
145, Cannon St., LONDON.

PAGE & ROWLINGSON, Chartered Patent Agents.

Mr. PAGE, who is a Whitworth Exhibitioner and an Associate Member of the Institute of Civil Engineers, has had a large experience as a Practical Mechanical Engineer, and is specially qualified to deal with the most intricate mechanical problems successfully. Write for Handbook of Information Free.

28, NEW BRIDGE STREET, LONDON, E.C.,
And 14, St. Ann's Square, Manchester.

The "SHAW" Patent Steam Valves . .



With Renewable Seats, Interchangeable Concentric Valve, Compound Packing to Spindle, Special Metal, and High-Class Workmanship.

The "SHAW" Patent Parallel Slide Valve is the Acme of Simplicity and Durability.

Try Them! Sent on Approval.



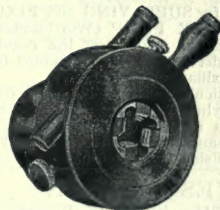
Write for particulars of these and other Specialities for High Pressure Steam.

JOSEPH SHAW, B Dept., HUDDERSFIELD.

"THOMPSON" DISH ENDED LANCASHIRE BOILERS

can be supplied ex-stock. Advantages Overcomes grooving on end plate and cracking of flue flanges; freedom for expansion; no stay plates or leaky stay rivets; firebox easily cleaned.

JOHN THOMPSON, WOLVERHAMPTON.



HARTNESS AUTOMATIC OPENING DIE

The most satisfactory means yet devised for the production of screw threads.

JONES & LAMSON MACHINE CO.,
JUBILEE BUILDINGS,
97, Queen Victoria Street, LONDON.

PAGE'S WEEKLY

Contracts

CONTRACTS.

ASYLUMS COMMITTEE OF LONDON COUNTY COUNCIL.

The Asylums Committee of the London County Council are prepared to receive TENDERS for the INSTALLATION OF HEATING, VENTILATING, and HOT-WATER PLANT at the Long Grove, Asylum, Epsom, Surrey, now in course of erection.

Instructions for Tender and forms of Tender and Contract, with specification and schedules thereto annexed, together with plans and cover, can be obtained from the Clerk of the Committee, No. 6, Waterloo Place, London, S.W., on or after Thursday, the 1st December proximo, on payment of a deposit of £5 for each copy. The amount deposited will, after the Committee have come to a decision upon the Tenders received, but not before, be returned to the tenderer, provided he shall have sent in a *bonâ fide* Tender and shall not have withdrawn the same.

Tenders must be on the printed form, and must be accompanied by the form of contract and schedules thereto and bond.

The Tender and accompanying documents, completed in accordance with the instructions, must be enclosed in the authorised sealed cover, endorsed "Tender for Heating, Long Grove Asylum," and be delivered at the Office of the Committee, 6, Waterloo Place, London, S.W., on or before Monday, the 23rd January, 1905, after which no Tender will be received.

Any Tender not made on the printed form, or not filled up and complete in every particular in accordance with the instructions, will be rejected.

The Committee do not bind themselves to accept the lowest or any Tender.

The contractor will have to enter into a bond in the penal sum of £4,000, with two approved sureties, each in the sum of £1,000, as security for the due performance of the contract.

R. W. PARTRIDGE,

Asylums Committee Office, Clerk of the Asylums Committee.
6, Waterloo Place, London, S.W.,
November 16th, 1904.

EAST INDIAN RAILWAY.—THE EAST Indian Railway Company is prepared to receive TENDERS for the SUPPLY and DELIVERY of:—

- (1) STEEL PLATES for BOILERS and BUFFER PLATES,
- (2) STEEL FISH PLATES,
- (3) STEEL FISH BOLTS, with special Nuts,
- (4) WROUGHT IRON PIPING,
- (5) PAINTS, &c.,

as per specifications to be seen at the Company's Offices.

Tenders are to be sent to the undersigned marked "Tender for Steel Boiler Plates, &c.," or as the case may be, not later than Twelve o'clock noon on Wednesday, the 30th day of November instant.

The Company reserves to itself the right to divide the order, also to decline any Tender without assigning a reason, and does not bind itself to accept the lowest or any Tender.

For each specification a fee of £1 is. is charged, which cannot under any circumstances be returned.

By order,

Nicholas Lane, London, E.C., C. W. YOUNG, Secretary.
November 17th, 1904.

ESSEX COUNTY ASYLUM, BRENTWOOD.

TENDERS are invited for SUPPLYING and FIXING a DIRECT-ACTING STEAM DUPLEX PUMP (Worthington type) of such design, material, and test as shall meet the requirements of the "National Standard Underwriter" duplex pumps for fire purposes, and to have automatic auxiliary arrangement.

Specification and particulars can be obtained from the Medical Superintendent at the Asylum, where the site can be seen.

Tenders to be sent in not later than the 3rd December next, addressed to the Sub-Committee for Water Supply at the Asylum, and should be marked outside "Fire Pump."

EAST COWES URBAN DISTRICT COUNCIL, ISLE OF WIGHT. TO PUMP MAKERS.

Subject to the sanction of the Local Government Board for the necessary loans being obtained,

The Council invite TENDERS for ONE SET of 8 in. THREE-THROW DEEP-WELL PUMPS, fitted and fixed in Well, with 6 in. Rising Main and all necessary Gear, &c., in accordance with printed forms of specification and Tender, which can be obtained from their Engineer, W. Brown, 709, High Road, Tottenham, or from Albert E. Barton, Town Hall, East Cowes, Surveyor to the Council, upon the deposit of £2 2s., which will be returned on receipt of a *bonâ fide* Tender.

The person or firm whose Tender is accepted will be required to enter into a written contract and to provide two sureties.

Sealed Tenders to be sent to the Offices of the Council, Cowes, addressed to the Clerk of the Urban District Council, and endorsed "Tender for 8 in. Three-throw Pumps," on or before the 7th December, 1904.

The Council do not bind themselves to accept any Tender.

Council Offices, Cowes, Atherstone Damant,
November 12th, 1904. Clerk to the Council.

COUNTY OF LONDON.—TO GAS ENGINEERS AND OTHERS.

The London County Council invites TENDERS for the SUPPLY, DELIVERY, and ERECTION, complete, of three MAIN-DRIVING GAS ENGINES, together with certain AUXILIARY GAS ENGINES and all accessories, at the Council's Falcon Brook Pumping Station, to be erected in York Road, Battersea.

Persons desiring to submit Tenders may obtain the drawings, specifications, bills of quantities, form of Tender, and other particulars, upon application to the Council's Chief Engineer, Mr. MAURICE FITZMAURICE, C.M.G., at the County Hall, Spring Gardens, S.W., and upon payment to the Cashier of the Council of the sum of Two Pounds. This amount will, after the Council or its Committee have come to a decision upon the Tenders received, but not before, be returned to the tenderer, provided he shall have sent in a *bonâ fide* Tender and not have withdrawn the same.

Tenders must be upon the official forms, and the printed instructions contained therein must be strictly complied with.

The contractors will be bound by the contract to pay to all workmen (except a reasonable number of legally bound apprentices) employed by them wages at rates not less and to observe hours of labour not greater than the rates and hours set out in the Council's list, and such rates of wages and hours of labour will be inserted in and form part of the contract by way of schedule.

Each Tender is to be delivered at the County Hall, in a sealed cover, addressed to the Clerk of the London County Council, Spring Gardens, S.W., and marked "Tender for Gas Engines, Falcon Brook Pumping Station."

No Tender will be received after 10 a.m. on Tuesday, the 6th day of December, 1904.

Any Tender which does not comply with the printed instructions for Tender may be rejected.

The Council does not bind itself to accept the lowest or any Tender, and it will not accept the Tender of any person or firm who shall on any previous occasion have withdrawn a Tender after the same had been opened, unless the reasons for the withdrawal were satisfactory to the Council.

G. L. GOMME,
Clerk of the London County Council.

County Hall, Spring Gardens, S.W.,
16th November, 1904.

EAST COWES URBAN DISTRICT COUNCIL, ISLE OF WIGHT.

TENDERS FOR MAIN FROM WATERWORKS TO TOWER.

Subject to the sanction of the Local Government Board for the necessary loans being obtained,

The Council invite TENDERS to LAY a 6 in. CAST IRON MAIN from the Waterworks to the Water Tower and along Victoria Grove, together with valves and all necessary fittings, in accordance with the printed forms of specifications and Tender, which can be obtained from their Engineer, W. Brown, 709, High Road, Tottenham, or from Albert Barton, Town Hall, East Cowes, Surveyor to the Council, upon the deposit of £2 2s., which will be returned on receipt of a *bonâ fide* Tender.

The person or firm whose Tender is accepted will be required to enter into a written contract and to provide two sureties.

Sealed Tenders to be sent to the Office of the Council, Cowes, addressed to the Clerk to the Urban District Council, and endorsed "Tender for Water Main," on or before the 7th December, 1904.

The Council do not bind themselves to accept any Tender.

Atherstone Damant,
Clerk to the Council.

Council Offices, Cowes,
November 12th, 1904.

EAST COWES URBAN DISTRICT COUNCIL, ISLE OF WIGHT.

TENDERS FOR ENGINE AND SUCTION GAS PLANT.

Subject to the sanction of the Local Government Board to the necessary loans being obtained,

The Council invite TENDERS for one 50-H.P. ENGINE and SUCTION GAS PLANT, fitted and fixed complete, in accordance with the printed forms of specification and Tender, which can be obtained from their Engineer, W. Brown, 709, High Road, Tottenham, or from Albert E. Barton, Town Hall, East Cowes, Surveyor to the Council, upon the deposit of £2 2s., which will be returned on receipt of a *bonâ fide* Tender.

The person or firm whose Tender is accepted will be required to enter into a written contract and provide two sureties.

Sealed Tenders to be sent to the Offices of the Council, Cowes, addressed to the Clerk to the Urban District Council, and endorsed "Tenders for Engine and Suction Gas Plant," on or before the 7th December, 1904.

The Council do not bind themselves to accept any Tender.

Atherstone Damant,
Clerk to the Council.

Council Offices, Cowes,
November 12th, 1904.

PAGE'S WEEKLY

Contracts

COUNTY BOROUGH OF CARDIFF. TO MAKERS OF PUMPING MACHINERY, STEAM BOILERS, AND GAS ENGINES.

The Corporation of the County Borough of Cardiff hereby invite competitive **DESIGNS** and **TENDERS** (from manufacturers of repute only in the particular class of work tendered for) for the **SUPPLY, DELIVERY, and ERECTION** of **PUMPING MACHINERY** and **PLANT** required in connection with the proposed Western District Main Outfall Sewer as follows:—

CONTRACT No. 1.—For combined Sewage Pumping Engines and Pumps of a maximum capacity of 700,000 gallons per hour.

CONTRACT No. 2.—For the Steam Generating Plant required for Contract No. 1.

CONTRACT No. 3.—For two Sets of Gas Engines and Centrifugal Storm-water Pumps, each capable of discharging 680,000 gallons per hour.

Drawings and provisional specification may be seen and full particulars as to the contemplated works may be obtained at the office of Mr. W. HARPUR, M.Inst.C.E., the Borough Engineer, Town Hall, Cardiff, on and after Monday November 7th, and copies of the drawings and specification, with forms of Tender, will be supplied on receipt of a deposit of Five Guineas, which deposit will be returned on receipt of a *bona fide* Tender.

Tenders, sealed and endorsed "Tenders for Pumping Machinery," to be delivered at my office on or before Wednesday, December 21st.

The Corporation does not bind itself to accept the lowest or any Tender, and will not be liable for or defray any costs incurred in the preparation of any Designs and Tenders.

Town Hall, Cardiff,
October 31st, 1904.

J. L. WHEATLEY, Town Clerk.

BOROUGH OF CHIPPENHAM URBAN DISTRICT COUNCIL.

WORKS OF SEWERAGE AND SEWAGE DISPOSAL.

The Chippenham Urban District Council are prepared to receive **TENDERS** for the following **NEW SEWERS**, with **MANHOLES**, **FLUSHING CHAMBERS**, and other works connected therewith:—

About 850 yards of 9 in. diam. Pipe Sewers.

2280	12 in.
627	15 in.
564	18 in.
848	21 in.

The building of Detritus and Screening Tanks, Liquifying Tanks, Contact Filter Beds, Low-level Collecting Tank, Percolating Storm Filter, Engine and Pump House. The fixing of all Machinery, Valves, Pipes, &c.

Conditions, specification, quantities, and form of Tender may be obtained from the Engineer, Mr. A. E. ADAMS, A.M.I.M.E., High Street, Chippenham, Wilts, on payment of the sum of £2 2s., which will be returned on the receipt of a *bona fide* Tender and of the conditions, specification, and priced quantities.

The drawings may be seen at the Engineer's Office.

Sealed Tenders, upon the form supplied, to be sent in addressed to the Town Clerk, Chippenham, Wilts, not later than Ten o'clock in the morning of Tuesday, the thirteenth day of December, 1904, and endorsed "Tender for Chippenham Main Drainage, &c."

The Council do not bind themselves to accept the lowest or any Tender.

Chippenham, Wilts. FRANCIS H. PHILLIPS, Town Clerk.
November, 1904.

TO CIVIL ENGINEERS.

COMPETITION FOR DRAINAGE SCHEME for ROSS (HEREFORDSHIRE) URBAN DISTRICT COUNCIL.

The Council desire to provide for the **DRAINAGE** and **DISPOSAL** of the **SEWAGE** of the present Urban District, together with the area proposed to be added, and for that purpose **INVITE COMPETITIVE SCHEMES**.

Competitors to supply Plans, Sections, Specification, detailed Report and Estimate of the probable cost, which are to be delivered at the Offices of the undersigned not later than December 5th, 1904.

Premiums of £50, £25, and £10 will be paid by the Council for the Schemes which they may adjudge to be best in order of merit, and such Plans and Particulars to become the absolute property of the Council.

In the event of either Scheme being carried out, the premium will merge in the fees paid to the Engineer.

It is suggested that Competitors should in the preparation of their Schemes, have due regard to the initial cost of the Works, as well as the annual cost of maintaining and working the system.

The Council do not pledge themselves to carry out any of the proposed Schemes, but in the event of any Scheme being selected, it will be conditionally that the same be approved by the Local Government Board, and that the cost does not materially exceed the estimate submitted.

The Plans and Particulars to bear a distinctive motto, and a sealed envelope bearing the same motto and containing the name and address of the Competitor, to accompany the papers.

Any further information can be obtained upon application to the Town Surveyor, and

Albion Chambers, Ross,
October 21st, 1904.

ERNEST R. DAVIES, Clerk.

JOHANNESBURG MUNICIPALITY.

The Municipal Council of Johannesburg is prepared to receive

TENDERS FOR

TWO 35 ton **ELECTRIC OVERHEAD TRAVELLING CRANES**

to Specification No. 9 of their Consulting Engineers, Messrs. MORDEY AND DAWBARN, 82, Victoria Street, London, S.W.

Copies may be seen on and after Saturday, November 5th, at the Council Offices, Johannesburg and at the Consulting Engineers' Offices in London, and may be obtained on payment of Five Guineas, which will be returned on receipt of a *bona fide* Tender.

Tenders must be addressed to Messrs. MORDEY AND DAWBARN, 82, Victoria Street, Westminster, S.W., and received by them not later than **TUESDAY, December 27th, 1904.**

The lowest or any Tender will not necessarily be accepted, and the Council will not be responsible for any expenses incurred in Tendering.

R. FEETHAM,

Johannesburg.

Town Clerk.

JOHANNESBURG MUNICIPALITY.

The Municipal Council of Johannesburg is prepared to receive

TENDERS FOR:—

TRANSFORMER PILLARS and **SWITCHGEAR** to Specification No. 8, of their Consulting Engineers, Messrs. MORDEY AND DAWBARN, 82, Victoria Street, London, S.W.

Copies may be seen on and after Saturday, November 5th, at the Council Offices, Johannesburg, and at the Consulting Engineers' Offices in London, and may be obtained on payment of Five Guineas, which will be returned on receipt of a *bona fide* Tender.

Tenders must be addressed to Messrs. MORDEY & DAWBARN, 82, Victoria Street, Westminster, S.W., and received by them not later than **TUESDAY, December 27th, 1904.**

The lowest or any Tender will not necessarily be accepted, and the Council will not be responsible for any expenses incurred in Tendering.

R. FEETHAM,

Johannesburg.

Town Clerk.

APPOINTMENTS OPEN.

EGYPTIAN GOVERNMENT.

PUBLIC WORKS DEPARTMENT.

APPLICATIONS ARE INVITED FOR THE POST OF INSPECTOR OF IRRIGATION in the above service, for a period of five years, at an annual salary of One Thousand Egyptian Pounds, and a gratuity of one year's salary at the end of this period.

Applicants must be of English birth, and their age must not exceed 45 years. They must have had at least 15 years' service in the Irrigation Branch of the Indian Public Works Department.

Applications, which should contain a full statement of services, with certificates or references, should be addressed to—

THE UNDER SECRETARY OF STATE.

Public Works Department, Cairo, Egypt.

CITY OF SHEFFIELD. — DERWENT

VALLEY WATER ACT, 1899.

The Corporation of Sheffield invite **APPLICATIONS** from competent engineers for the **APPOINTMENT OF RESIDENT ENGINEER** in the construction of a tunnel for the purpose of conveying water from the works of the Derwent Valley Water Board at Ladybower, to the works of the Sheffield Corporation in the Rivelin Valley, a total length of nearly five miles, of which a length of about 1,700 yards has already been driven.

The gentleman appointed will be required to reside in the immediate vicinity of the Tunnel works, and to devote the whole of his time to his duties under the Corporation.

He will have daily personal charge of the work, and be responsible for it throughout, and will perform all special work and duties in connection therewith which the Water Committee of the Corporation may desire.

The staff of assistants, inspectors, and others is provided by the Corporation, and will be under the direction of the engineer.

The engineer will be required to confer with the consulting engineer with regard to all plans and designs, and at every step during the progress of the work, but without thereby lessening his own absolute responsibility, and he shall report direct to the Water Committee, from whom alone he will take instructions.

It is indispensable that candidates for the appointment should have had considerable experience both in the design and carrying out of similar works, either under a contractor or by administration under a public authority.

Applicants must state age, experience, present position, salary required, when at liberty, and forward copies of testimonials, and the names of two references.

Personal canvassing will be a disqualification. Applications to be sent to me not later than Monday, the 28th day of November instant, endorsed "Rivelin Tunnel Engineer."

By order,

HENRY SAYER,

Town Clerk.

Town Hall, Sheffield,
9th November, 1904.

BUYERS' DIRECTORY.

NOTE.—The display advertisements of the firms mentioned under each heading can be found readily by reference to the Alphabetical Index to Advertisers on pages 43, 45, 46, and 48.

In order to assure fair treatment to advertisers, each firm is indexed under its leading speciality ONLY.

Advertisers who prefer, however, to be entered under two or more different sections can do so by an annual payment of 5s. for each additional section.

Artesian Well Machinery.

John Z. Thom, Patricroft, Manchester.

Belting.

Binney & Son, Catherine Street, City Road, London, E.C.
Fleming, Birkby & Goodall, Ltd., West Grove, Halifax.
Rossendale Belting Co., Ltd., 10, West Mosley Street, Manchester.

Boilers.

Clayton, Son & Co., Ltd., Leeds City Boiler Works, Leeds.
Grantham Crank & Iron Co., Ltd., Grantham.
John Thompson, Wolverhampton.

Boilers (Water-tube).

Babeock & Wilcox, Ltd., Oriel House, Farringdon Street, London, E.C.
Cochran & Co. (Annan), Ltd., Annan, Scotland.

Bolts, Nuts, Rivets, etc.

Herbert W. Periam, Ltd., Floodgate Street Works, Birmingham.
T. D. Robinson & Co., Ltd., Derby.

Books.

E. & F. N. Spon, 125, Strand, London, W.C.

Cables.

St. Helen's Cable Co., Ltd., Warrington, Lancashire.

Case-Hardening Compounds.

Hy. Miller & Co., Millgarth Works, Leeds.

Catalogues, Printing, &c.

Atlantic Press, Ltd., Weymouth Street, Manchester.
Southwood, Smith & Co., Ltd., Plough Court, Fetter Lane, London, E.C.
Spottiswoode Advertising Agency, 8, New Street Square, E.C.

Chucks.

Fairbanks Co., 78-80, City Road, London, E.C.

Cisterns, Tanks, &c.

F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Clutches (Friction).

David Bridge & Co., Castleton Ironworks, Rochdale, Lancashire.
H. J. H. King & Co., Nailsworth, Gloucestershire.

Colliery Plants.

Graham, Morton & Co., Ltd., Leeds.

Condensing Plant.

Concentric Condenser, Ltd., 23, Northumberland Avenue, London, W.C.
Mirrlees-Watson & Co., Ltd., Glasgow.

Consulting Engineers.

G. H. Hughes, A.M.I.M.E., 97, Queen Victoria Street, London, E.C.

Continental Railway Arrangements.

South Eastern & Chatham Railway Co.

Conveying and Elevating Machinery.

Adolf Bleichert & Co., Leipzig-Gohlis, Germany.
Brown Hoisting Machinery Co., 39, Victoria Street, London, S.W.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Graham, Morton & Co., Ltd., Leeds.
Temperley Transporter Co., 72, Bishopsgate Street Within, London, E.C.

Coverings (Boiler)

Magnesia Coverings, Ltd., Washington Station, co. Durham.

Cranes, Travellers, Winches, etc.

Joseph Booth & Bros. Ltd, Rodley, Leeds.
Thomas Broadbent & Sons, Ltd., Huddersfield.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Cranks.

Clarke's Crank & Forge Co., Ltd., Lincoln, England.

Cutters (Milling).

E. G. Wrigley & Co., Ltd., Foundry Lane Works, Soham, Birmingham

Destructors.

Hersfall Destructor Co., Ltd., Armley, Leeds.

Dredges and Excavators.

Delange & Cie, Mce., Hoboken, near Antwerp.
Lobnitz & Co., Ltd., Renfrew.
Rose, Downs & Thompson, Ltd., Old Foundry, Hull.

Economisers.

E. Green & Son, Ltd., Manchester.

Ejectors (Pneumatic).

Hughes & Lancaster, 47, Victoria Street, London, S.W.

Electrical Apparatus.

Allgemeine Elektrizitäts Gesellschaft, Berlin, Germany.
Broadbent, T. W., Victoria Electrical Works, Huddersfield.
Bruce Peebles & Co., Ltd., Edinburgh.
Brush Electrical Engineering Co., Ltd., Victoria Works Belvedere Road, London, S.E.
Crompton & Co., Ltd., Arc Works, Chelmsford.
Crypto Electrical Co., 3, Tyer's Gateway, Bermondsey Street, London, S.E.
Gent & Co., Ltd., Faraday Works, Leicester.
Greenwood & Batley, Ltd., Albion Works, Leeds.
India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., The, Silvertown, London, E.
Malher & Platt, Ltd., Salford Iron Works, Manchester.
Matthews & Yates, Ltd., Swinton, Manchester.
Mix and Genest, Berlin, W., Germany.
Nalder Bros. & Thompson, 34, Queen Street, London, E.C.
Newton Brothers, Full Street, Derby.
Phoenix Dynamo Manufacturing Co., Bradford, Yorks.
Premier Electrolyte Co., 26, Spital Square, London, E.
Simplex Steel Conduit Co., Ltd., 20, Bucklersbury, London, E.C.
Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.
Turner, Atherton & Co., Ltd., Denton, Manchester.
B. Weaver & Co., 22, Rosoman Street, Clerkenwell, London, E.C.

Engines (Electric Lighting).

J. & H. McLaren, Midland Engine Works, Leeds.

Engines (Locomotive).

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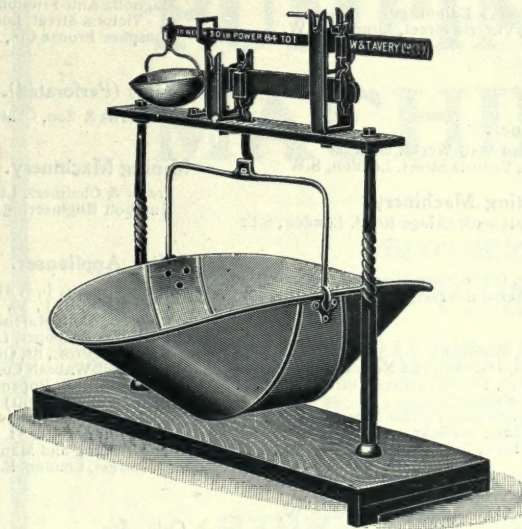
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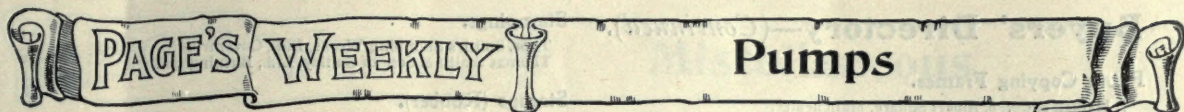
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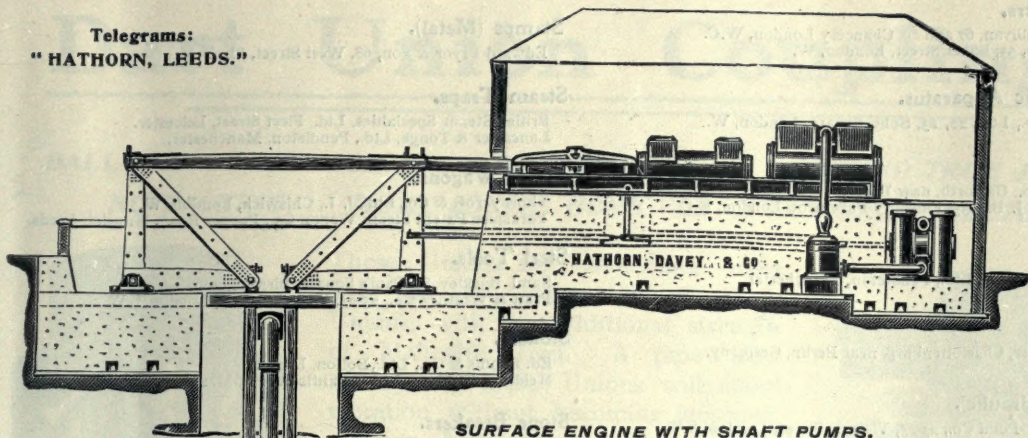
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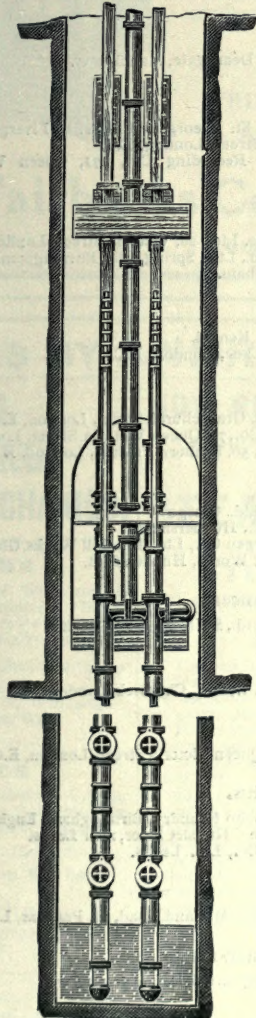
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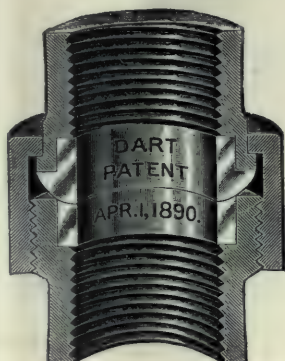
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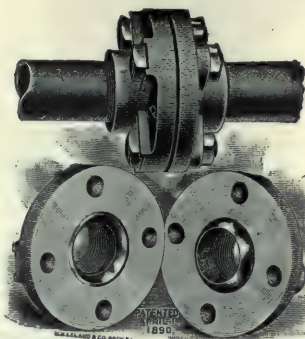
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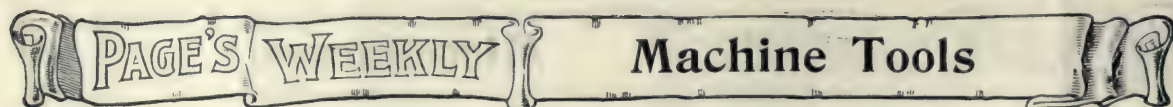
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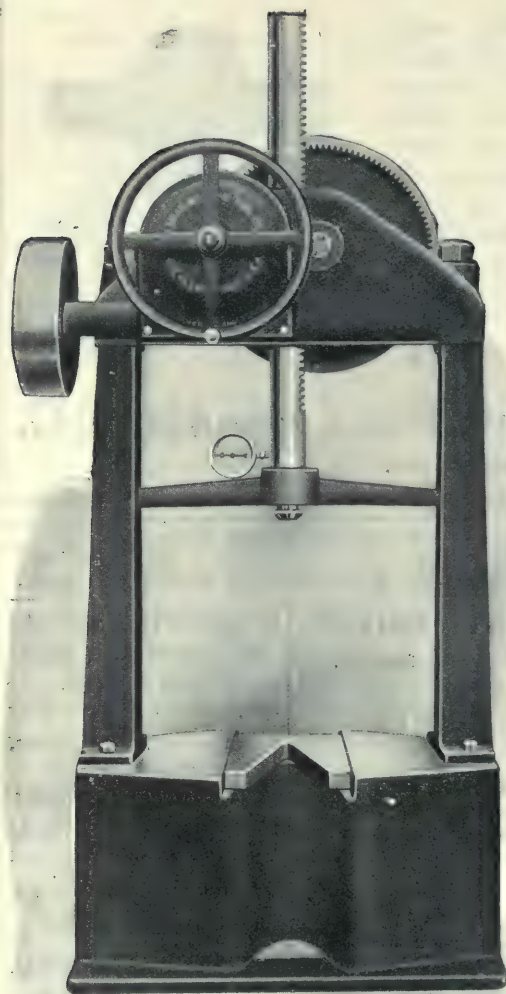
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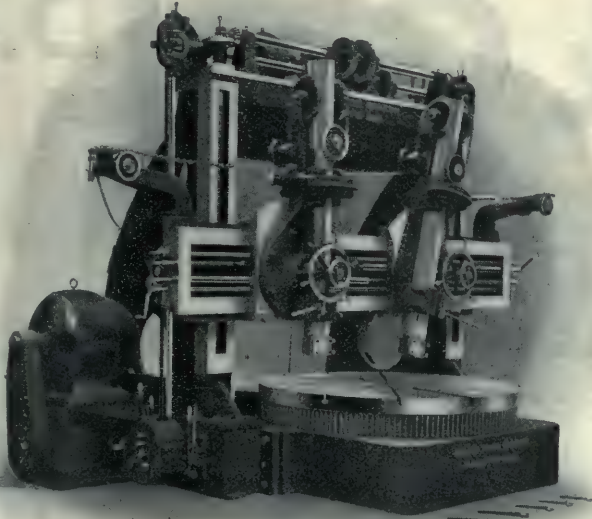
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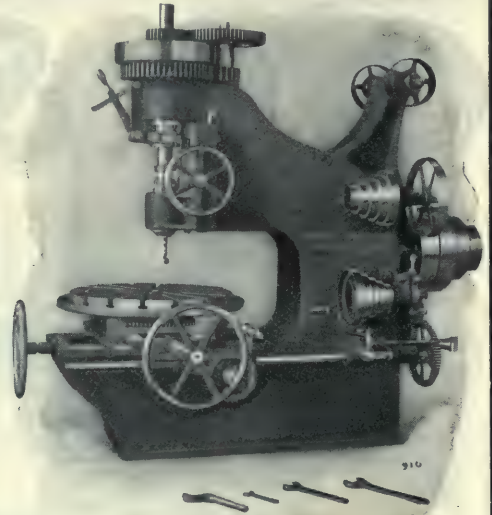
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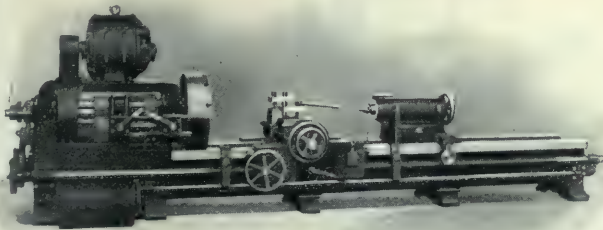


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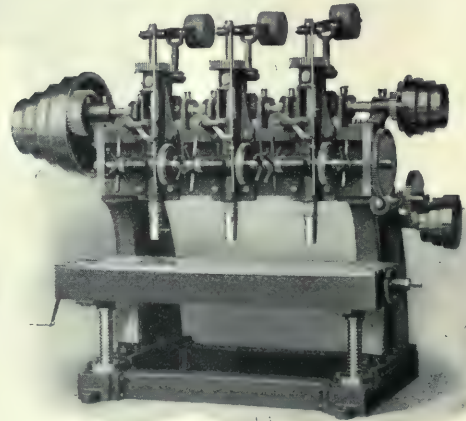
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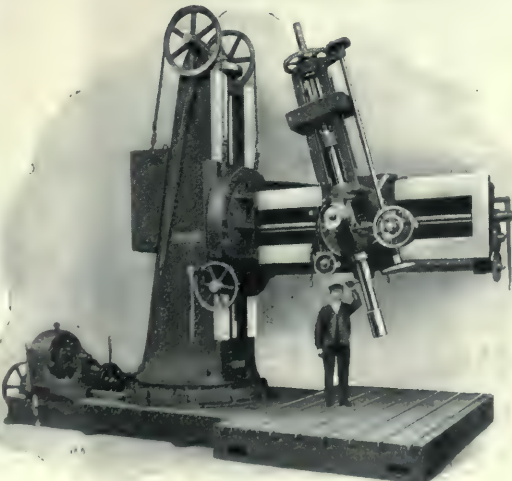
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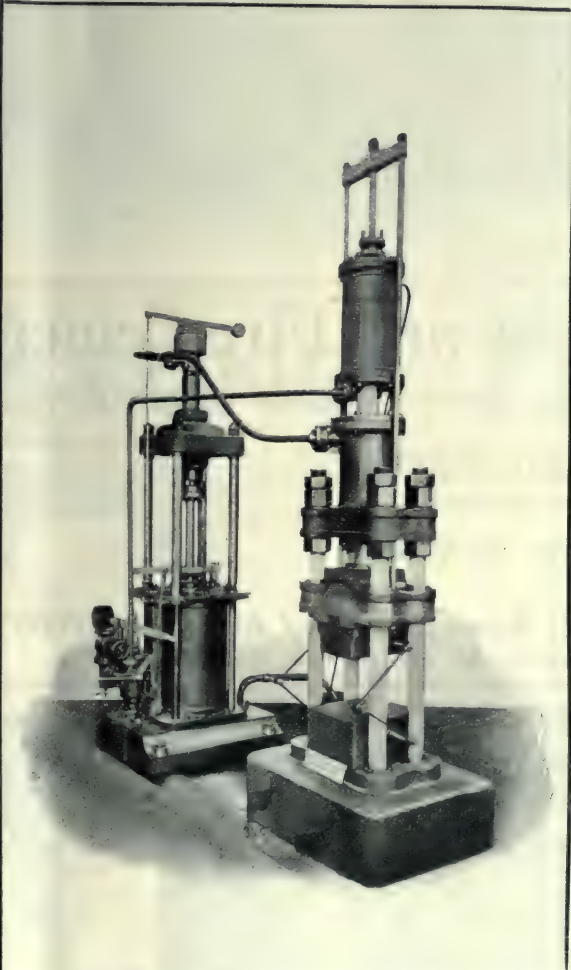
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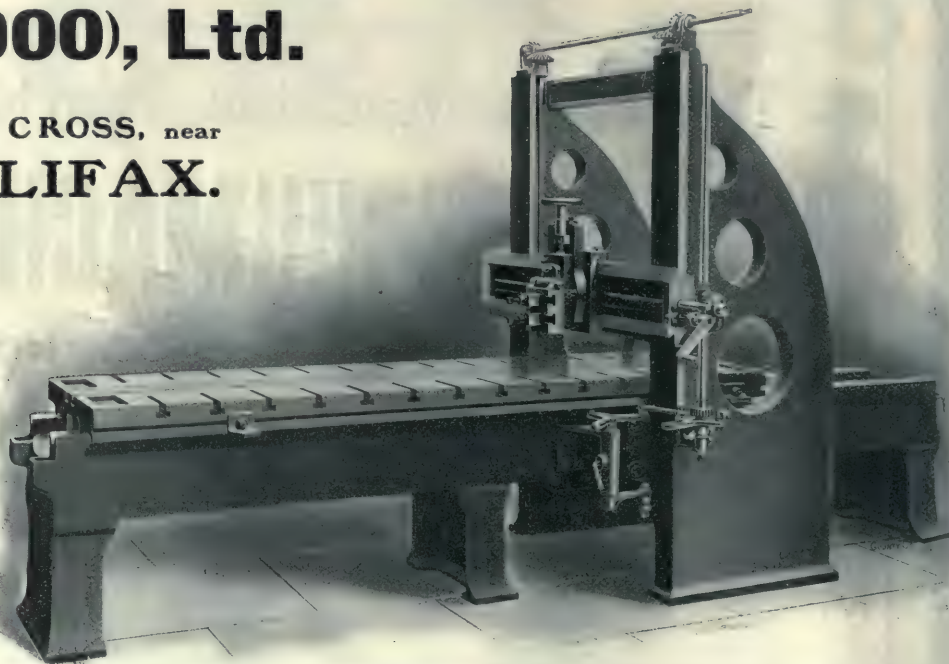
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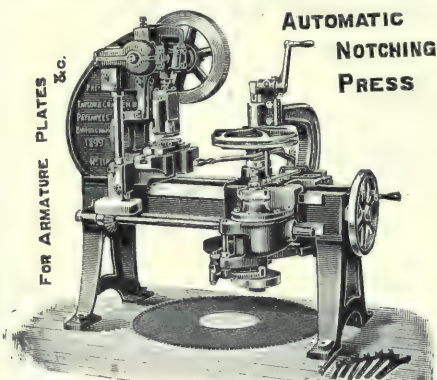


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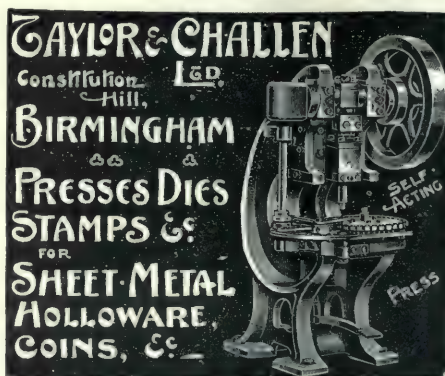


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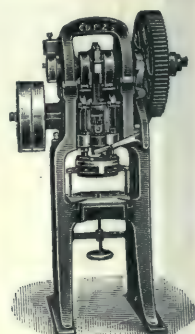


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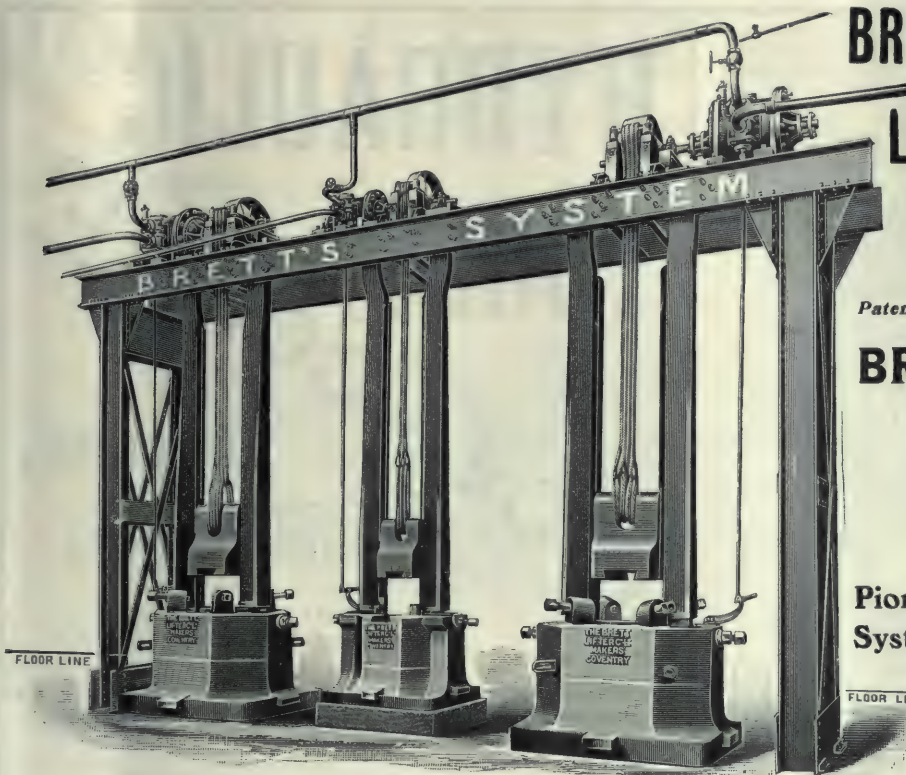
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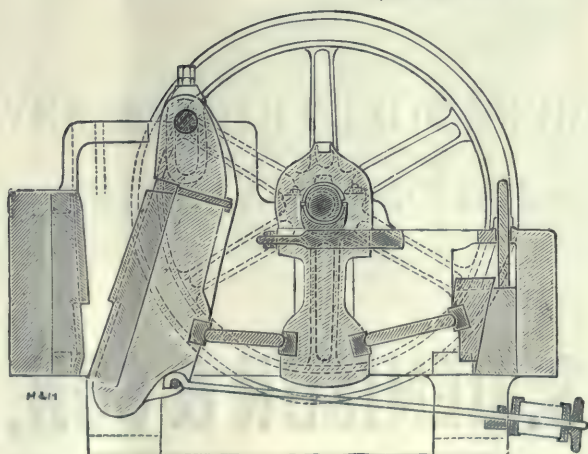
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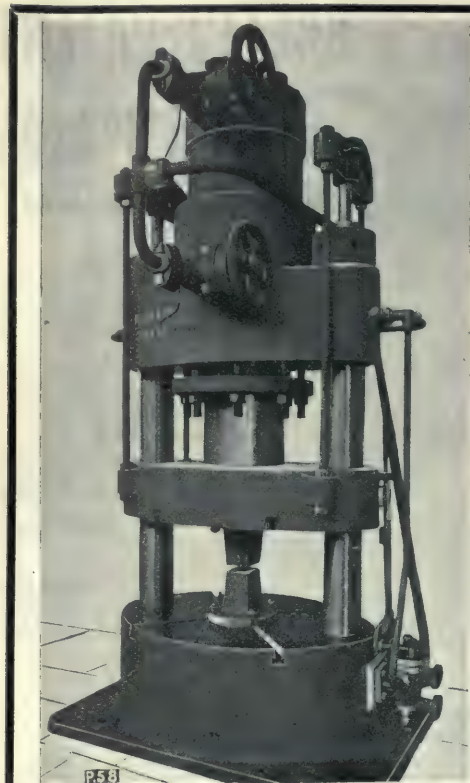
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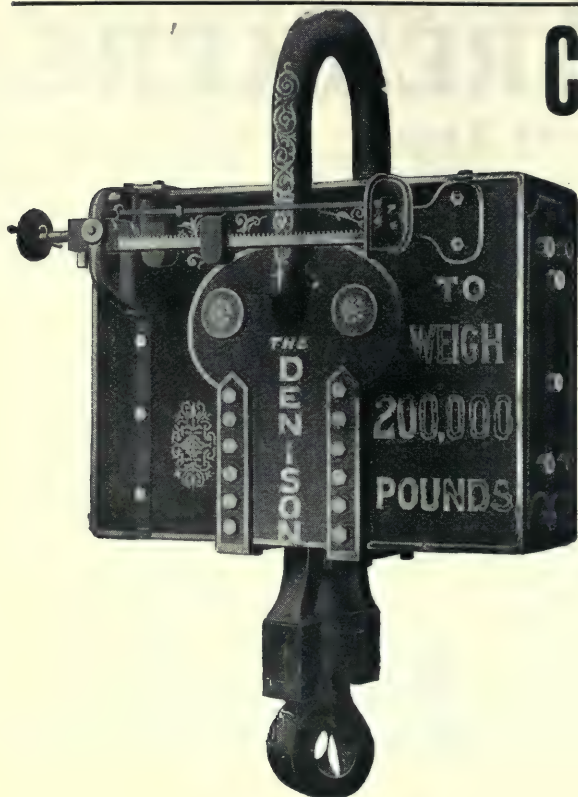
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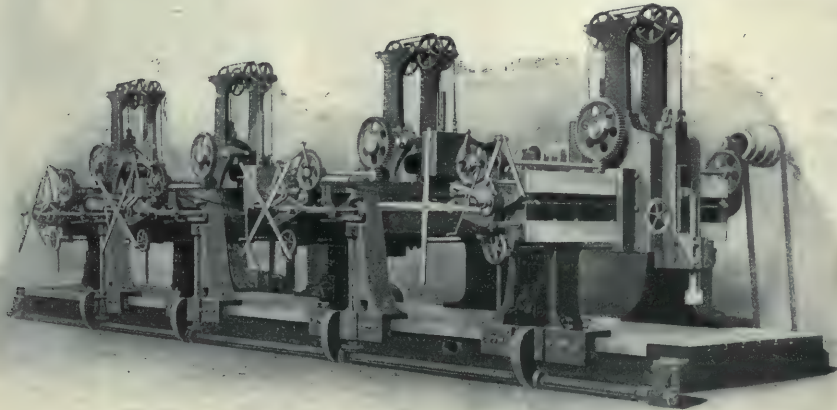


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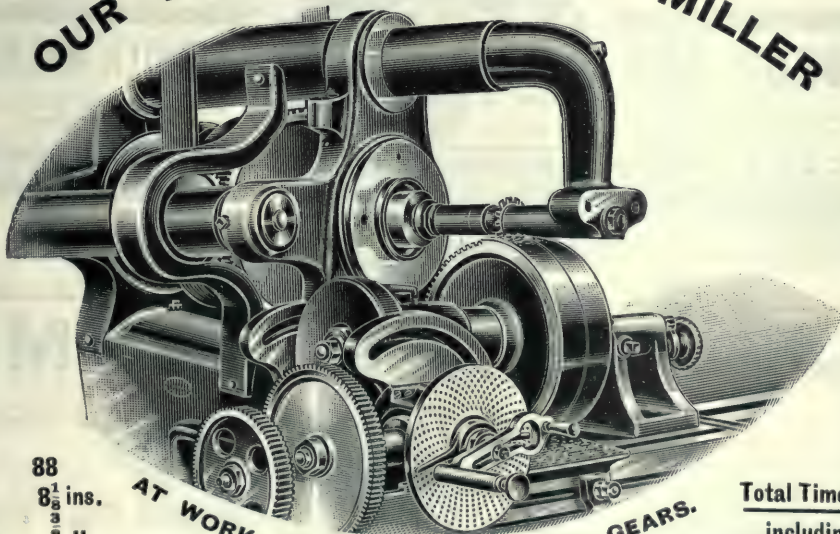
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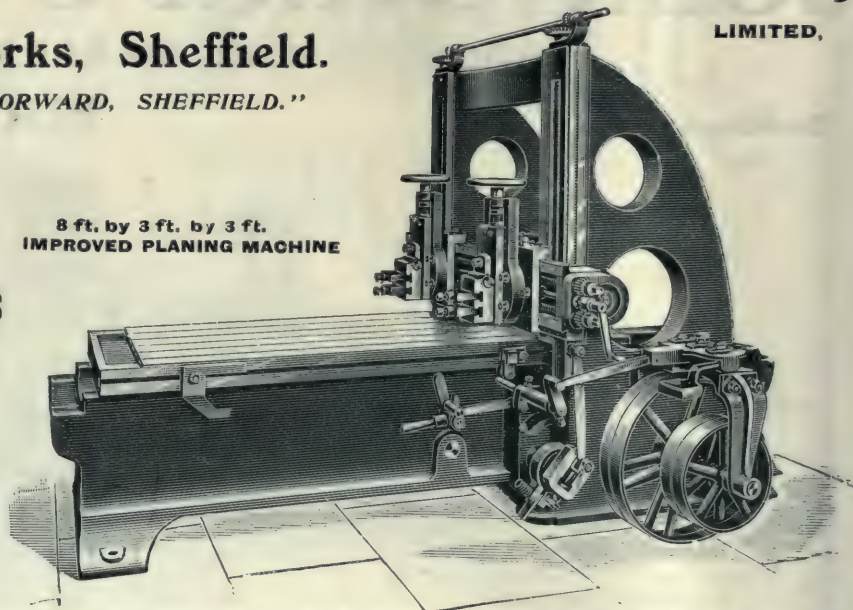
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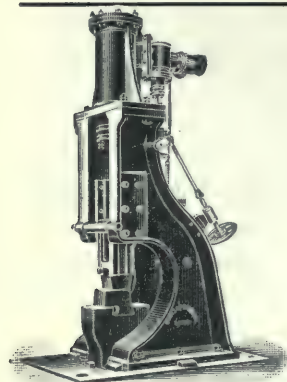
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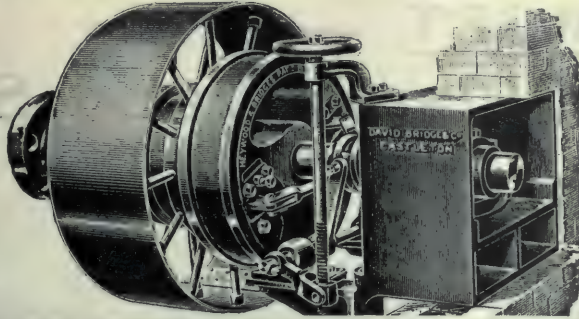
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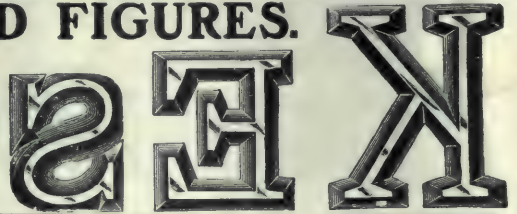
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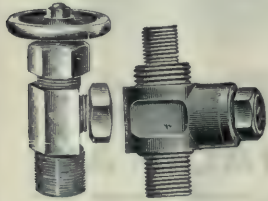
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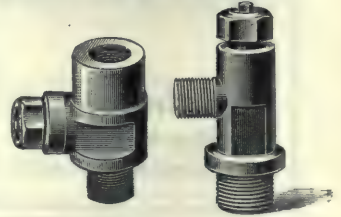


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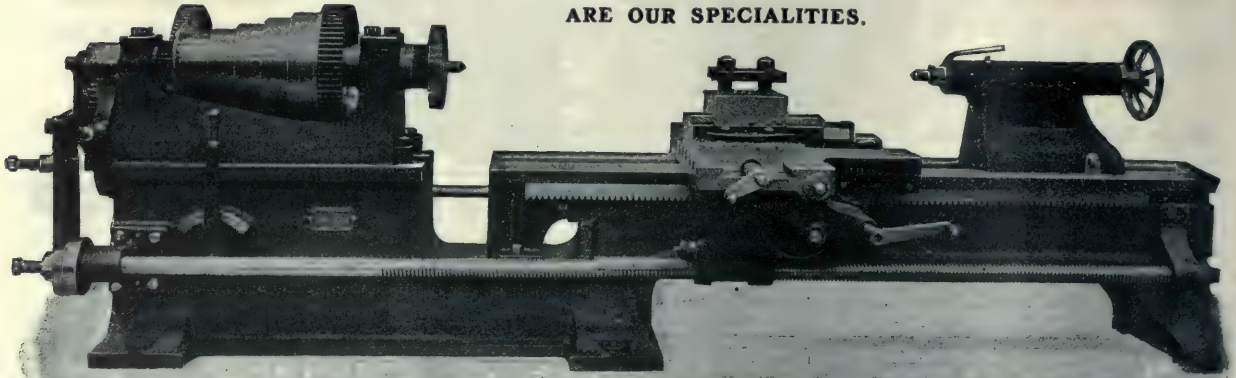
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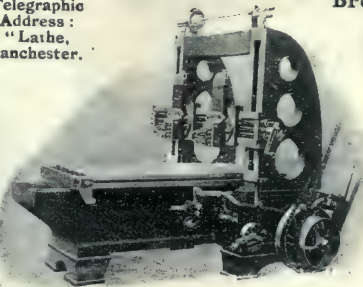
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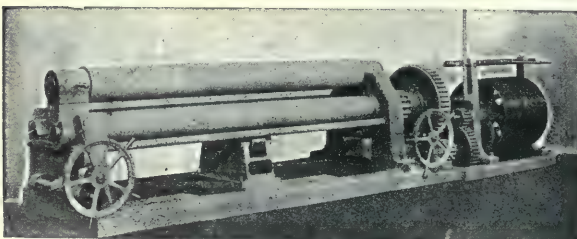


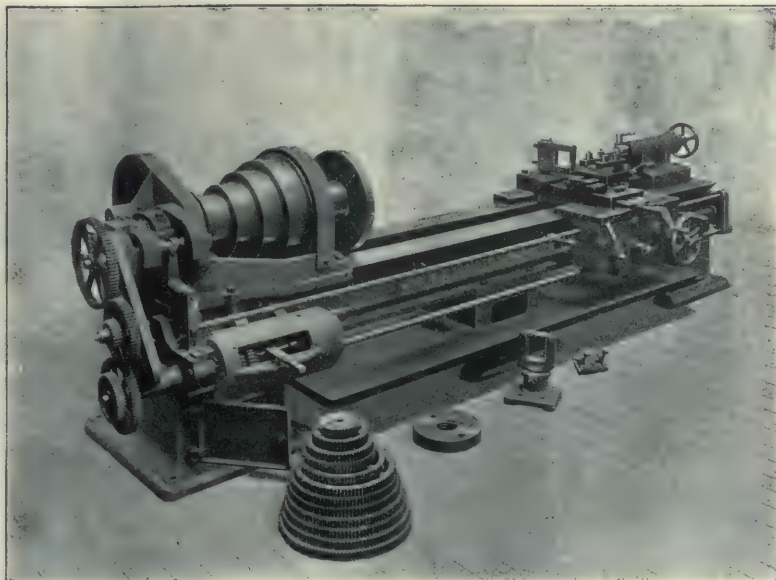
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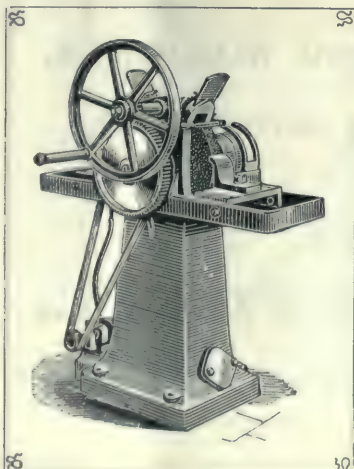
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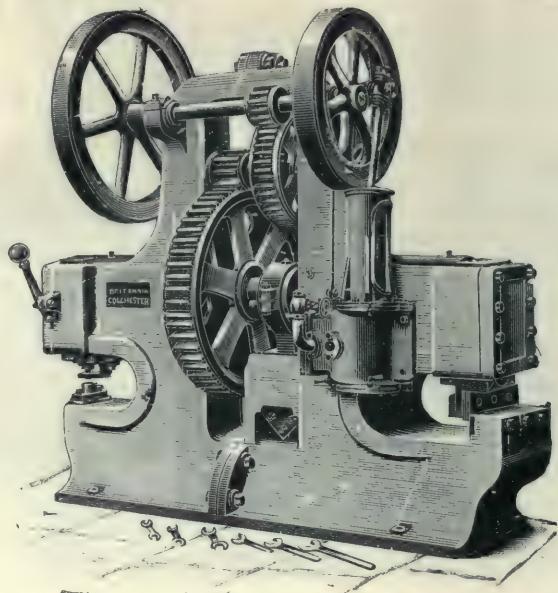
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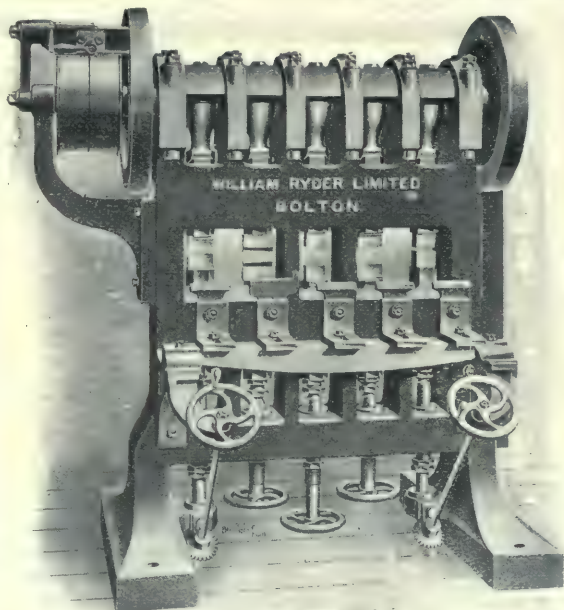


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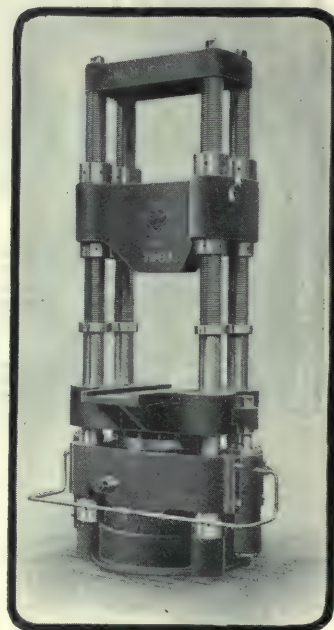
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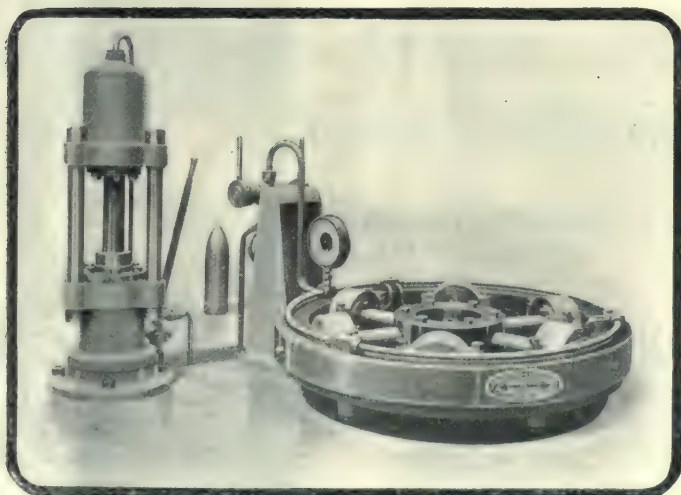
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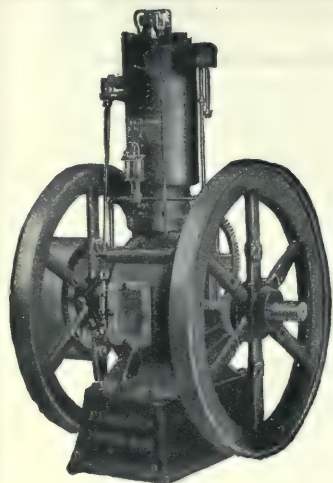


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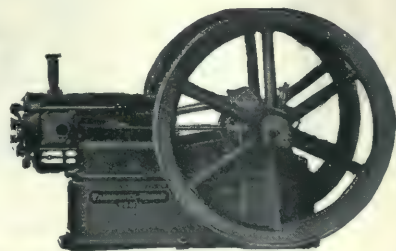
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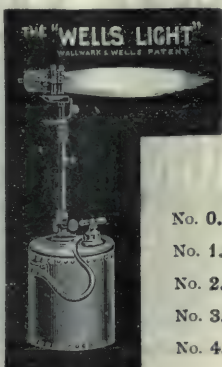
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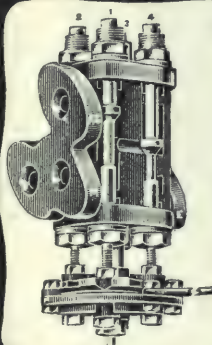
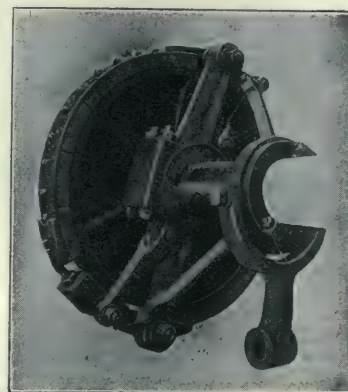
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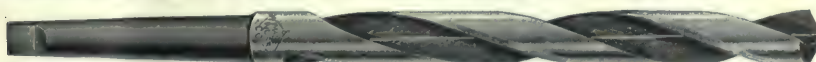
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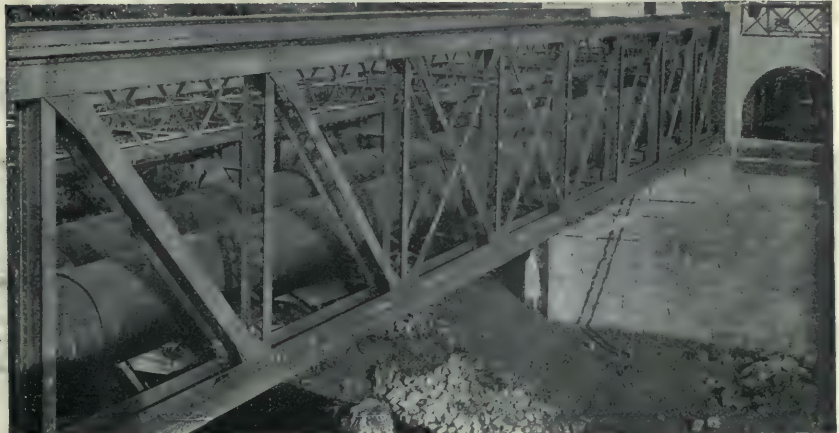
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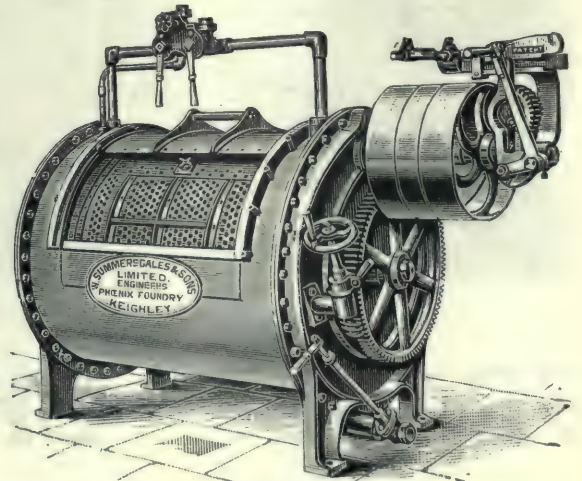
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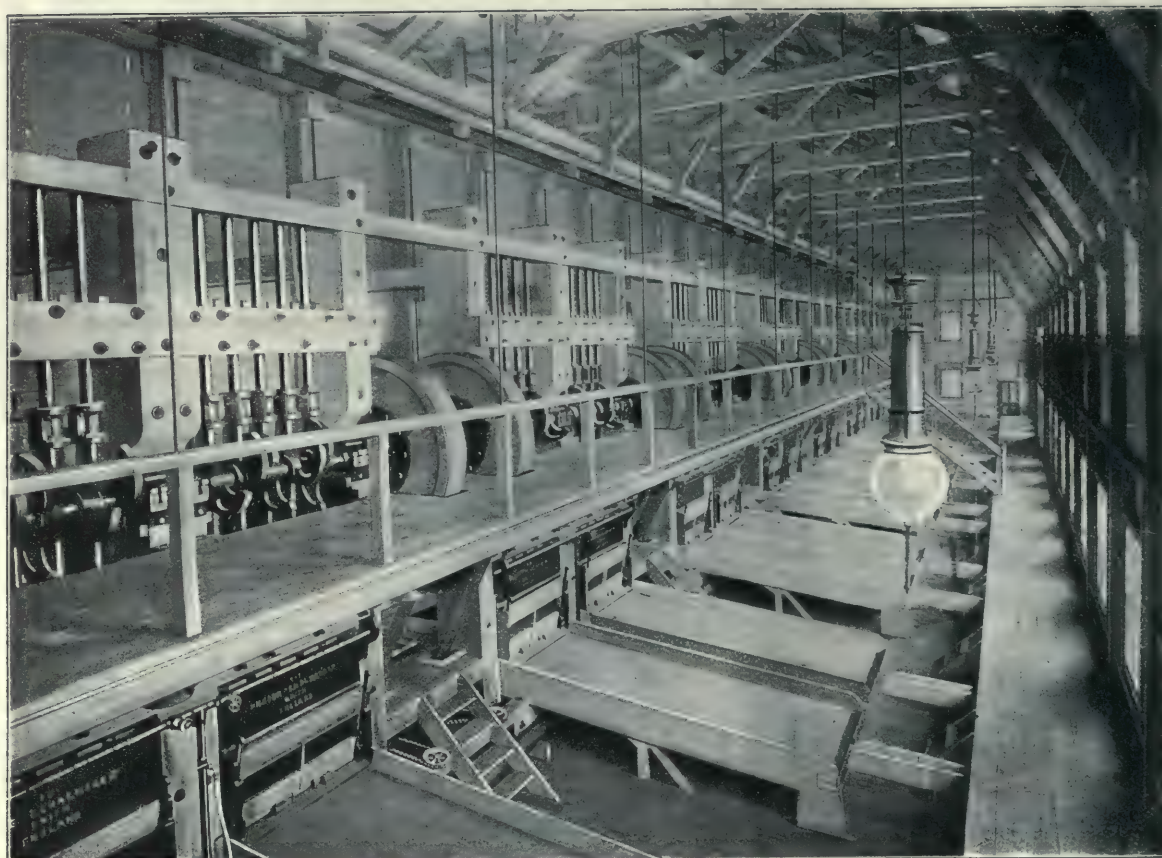


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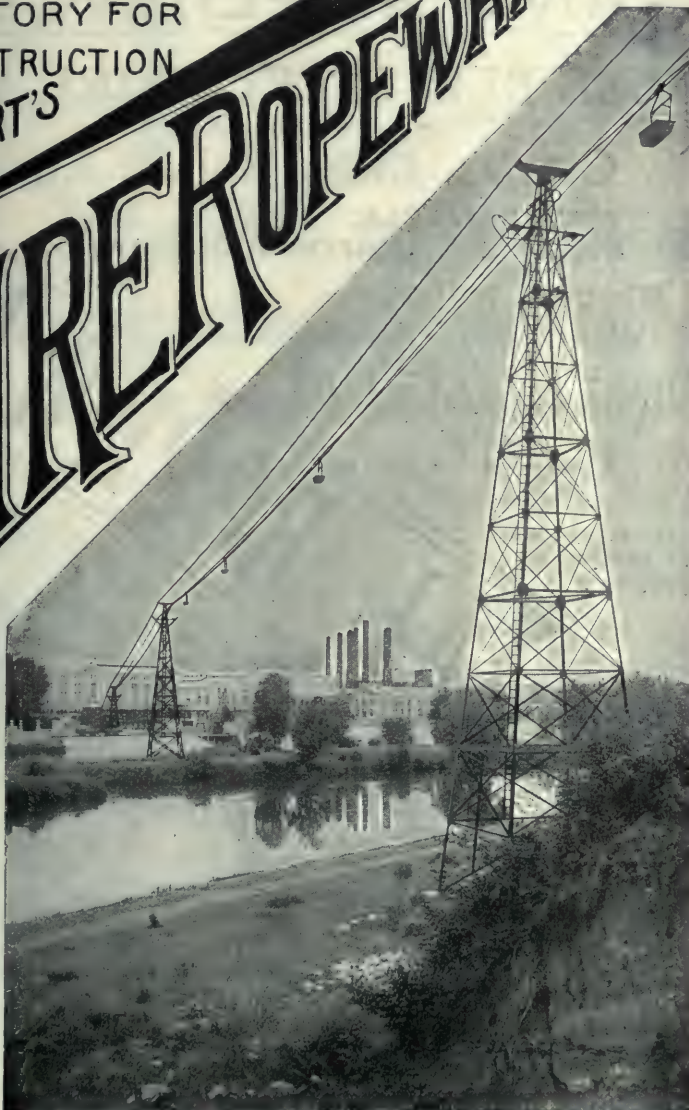
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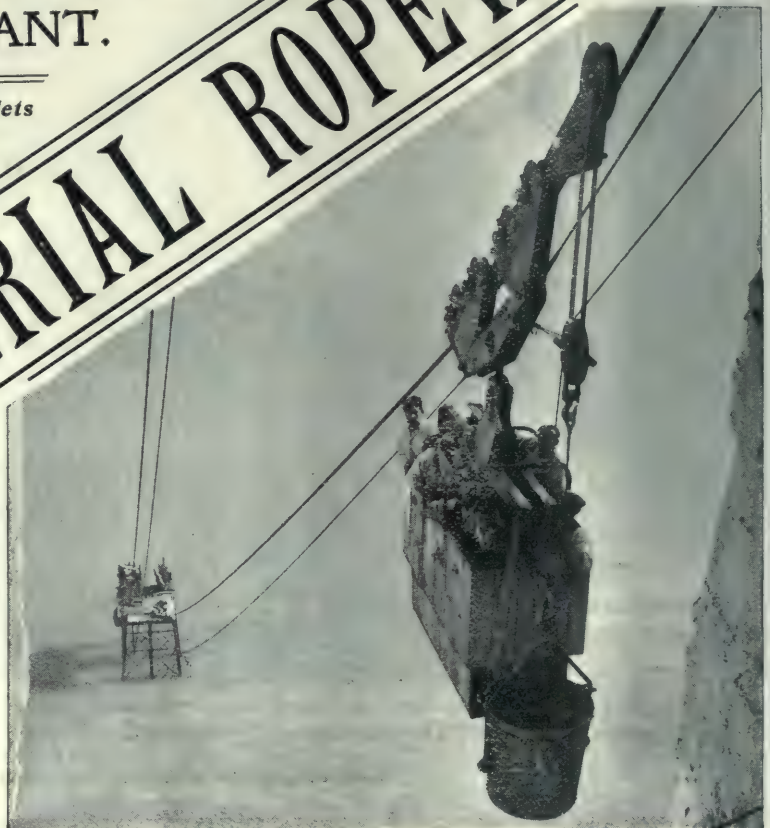
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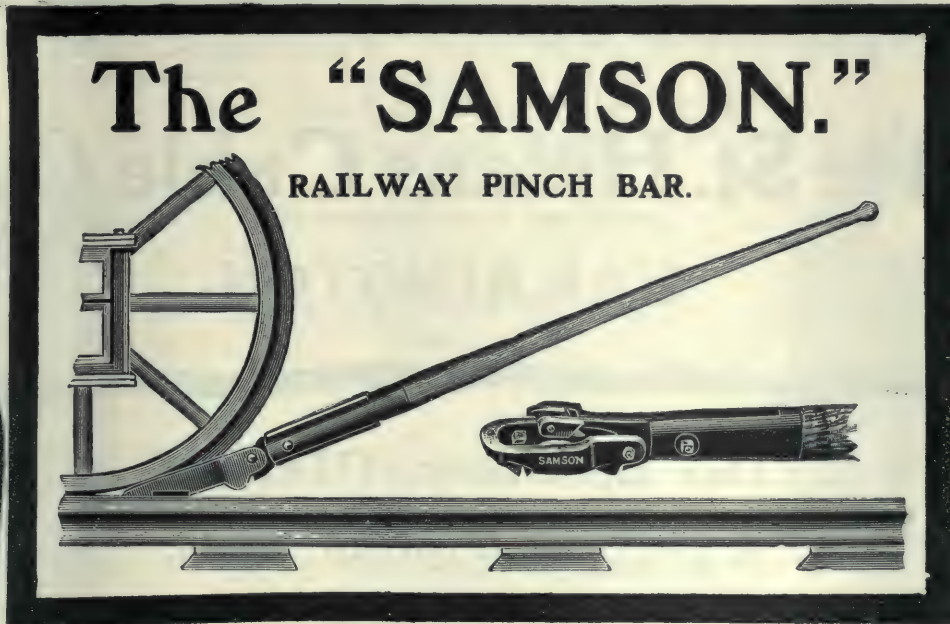
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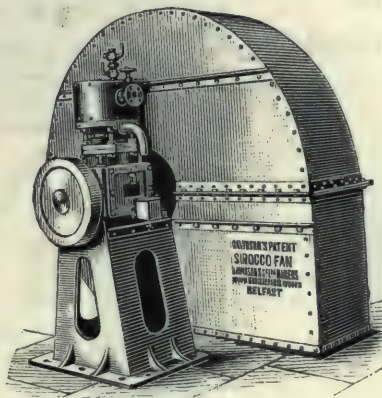
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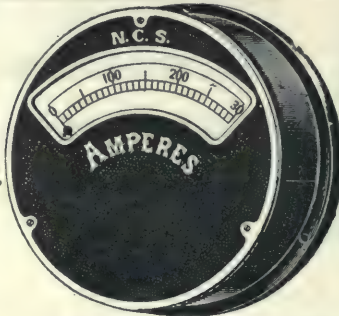
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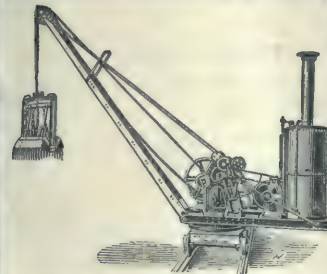
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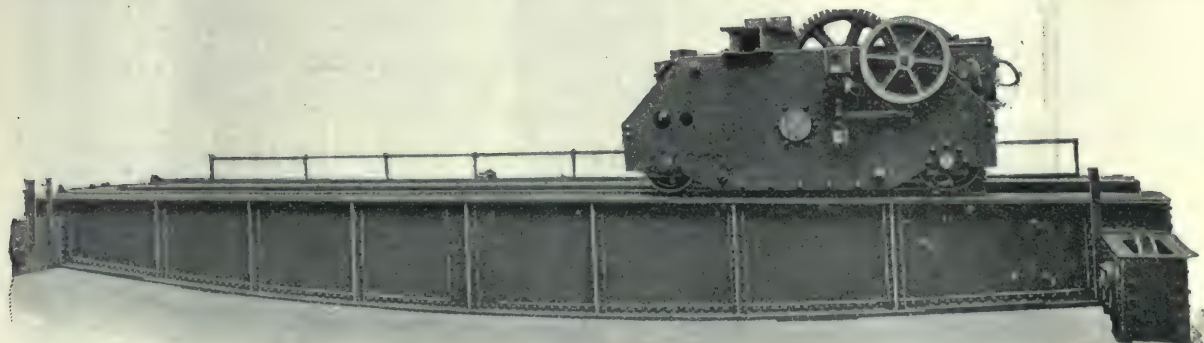
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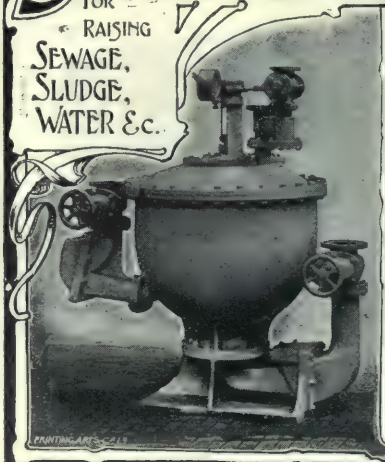
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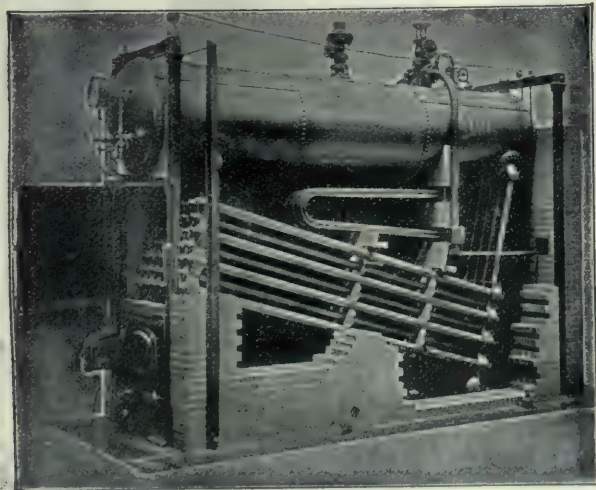
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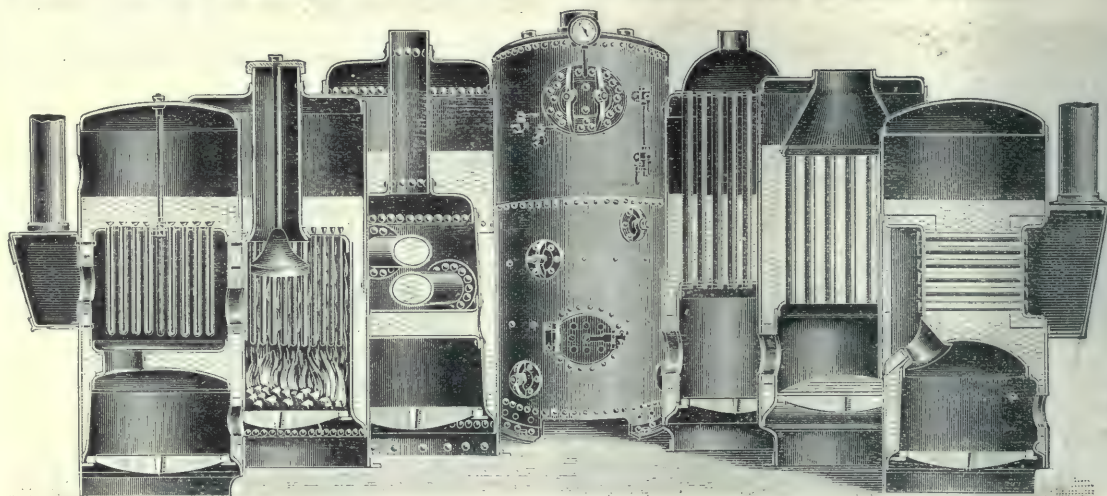
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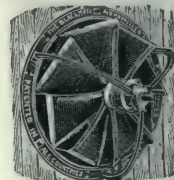
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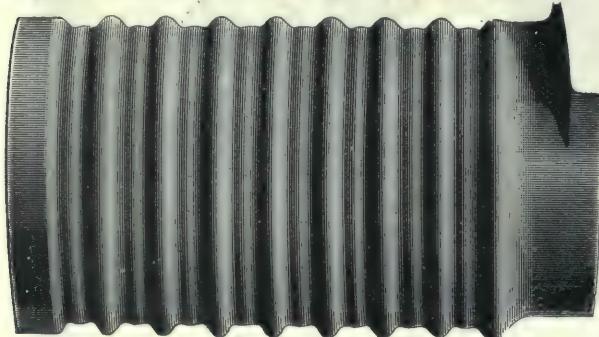


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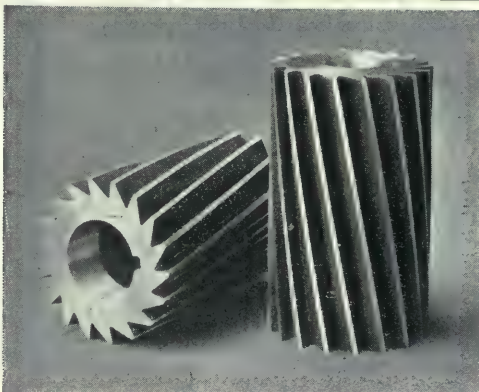
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PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

VOL. V.

LONDON, FRIDAY, NOVEMBER 25, 1904.

No. II.

The Offices of "Page's Weekly," Wednesday, Midnight.



WHILE engaged in some experiments upon a horizontal steam engine the other day, a curious fact about the crank-pin presented itself to my notice, and, as I do not recollect having come across any mention of it before, I place it upon record for the benefit of all whom it may concern. And it is this: There is a portion of the peripheral surface of the crank-pin which is never in the direct line of thrust of the connecting-rod, even in a reversible engine, and where a break in the continuity of the cylindrical surface would be productive of no harm whatever.

A moment's reflection will show that in a horizontal engine, working without compression, only one half of the pin's surface is covered by successive positions of the centre line of the connecting-rod. Imagine the crank to be on the dead-centre nearest to the cylinder, and the engine about to be slowly turned, say in the direction of the hands of a clock, only the surface of the lower half of the pin will be utilised during the half revolution. Upon arrival at the other dead-centre, the thrust of the connecting-rod is changed into a pull, and the same half of the pin comes into use again during the second half-revolution.

Were the engine turning the other way round, the other half of the pin's surface would

alone be in use, and of course in the case of a reversible engine the whole surface of the pin would at one time or another be in contact with the centre line of the connecting-rod. This is what would occur in an engine working without compression, or, in other words, when the reversal of connecting-rod stresses takes place exactly at the ends of the stroke; the



[Photo by Elliott and Fry.]

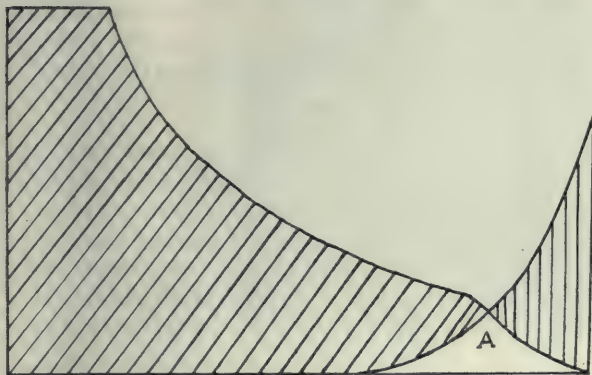
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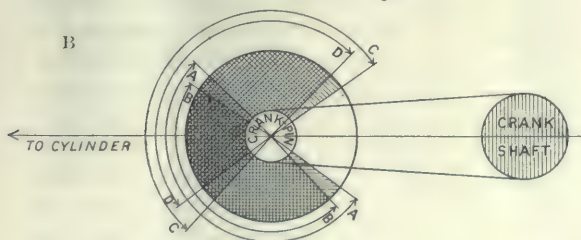
VIEWS IN THE WORKS OF THE DE LAVAL STEAM TURBINE COMPANY (See page 683).
 (1) Engineers' Office. (2) Gear Department. (3) Store Room. (4) Large Erecting Shop.

effect of compression is, of course, to gradually lead up to the pre-admission or counter-pressure upon the piston, and so to effect the reversal of stress without shock.

In every stroke there is a point at which the forces, whatever they may be, acting upon



each side of the piston, are in equilibrium, as at A in the indicator diagram, where the expansion line is intersected by the compression curve. It is immaterial for our purpose at what part of the stroke this occurs, but assuming that equilibrium takes place at seven-eighths of the stroke, then with a connecting-rod four cranks in length, the effect upon the crank-pin is as shown in the sketch. It will be seen that with the proportions mentioned that there is a considerable portion, about 80 degrees of arc of the crank-pin's surface which is never used, in the sense that of being in the direct line of connecting-rod pressure. The crank, as illustrated, is supposed to be lying on the dead-centre nearest to the cylinder.



For a clockwise rotation, the arc AA contains all the points of connecting-rod thrust, and BB are the points of pulling effort. In the opposite, or anti-clockwise direction, all the

thrust of the connecting-rod takes place within the arc CC, and all the pull within the arc DD.

The portion shown darkly shaded, from B to D, is in use twice in each revolution whether the rotation be clockwise or the reverse.

This effect may or may not be well known to the reader, and in any case it is more curious than useful, but I am free to confess that my idea of a crank-pin had always hitherto involved the assumption of contact over the whole surface at one time or another during the revolution.

The problems in connection with reinforced concrete have already received attention in PAGE'S WEEKLY, and the two papers on the subject read at the Royal Institution of British Architects on Monday last are interesting at this juncture. Mr. William Dunn's paper was confined to a consideration of the construction and strength of the material, while Mr. Mouchel, a pioneer in the use of ferro-concrete, dealt with monolithic constructions under the Hennebique system. He pointed out that the material has its own laws of deformation, that its elasticity is well marked, and that it is capable of withstanding severe tests. London enjoys the distinction, by the way, of being the only city in the world where ferro-concrete constructions are actually prohibited.

Owing to the absolute monolithism of Hennebique constructions, they are far less liable to vibrations than ordinary constructions. One of the things which strikes one most when entering a factory constructed entirely of ferro-concrete, where heavy machinery is at work, is the absence of vibrations and of noise. It is an everyday practice to attach shafting direct to the Hennebique pillars, which consequently have to sustain powerful lateral pulls. Heavy machines—such as disintegrators grinding heavy materials, dynamos, and dynamo-motors—are also fixed direct on the Hennebique floors; and, it is claimed that after years of such treatment the concrete remains unimpaired.

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

DAVIDGE PAGE, Editor.

Clun House, Surrey Street, Strand, London, W.C.

Telephone No: 3349 GERRARD.

Telegraphic and Cable Address: "SINEWY, LONDON."

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New Copy for Advertisements,

Alterations, &c., intended for insertion in the current week's issue must be delivered **not later than 4 p.m. on Monday.** If proofs are required the copy and blocks should reach us several days earlier.

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NEWS ITEMS.

PROFESSOR Henry Adams, M.Inst.C.E., has recently retired from the City of London College, where for thirty-five years he has been head of the Engineering Department; he is, however, still continuing his practice as a consulting engineer at 60, Queen Victoria Street, E.C., where he has had offices for the last twenty five years.

An automatic compass for use on board ship is described in the Bulletin de la Société Industrielle de Marseilles. It is claimed that the apparatus, which is the invention of M. Heit, automatically registers, minute by minute, the direction of the compass, so that by consulting the chart which is the result it is possible to exactly determine the route which was followed at a given moment of the passage.

In January of last year the London, Brighton, and South Coast Railway Company, put into regular service for main-line traffic a bogie coach fitted with the roller bearings of the Empire Roller Bearings Company. This coach has since run over 80,000 miles, and the behaviour of the bearings has been such as to decide the railway company to undertake further tests with them. For this purpose they have fitted throughout a complete train of close-coupled bogie vehicles, and it is now intended to run this train for a considerable time on the same service and with the same engine as another similar train of the same weight and length having ordinary bearings.

Mr. Allison Smith has been appointed locomotive superintendent for the Gold Coast Railways, West Africa. He will hold his position directly under the Colonial Office. Mr. Allison Smith was formerly locomotive superintendent to the New Zealand Government Railways, in which capacity he designed and built the extensive locomotive workshops at Addington, near Christchurch, the principal establishment of the kind in the Colony. Locomotive building is now carried on to a large extent in the Addington workshops. Subsequently, Mr. Allison Smith held the same position on the Victorian Government Railways (Australia), where also he designed and built the workshops, and where he entirely reorganised the service, establishing large reforms in method and discipline, particularly in the standardisation of stock, which avoided the necessity of keeping large stocks of duplicate parts, the result being very material



ELEVATING AND CONVEYING MACHINERY SHOWN BY MESSRS. GRAHAM, MORTON, AND CO., AT THE GAS EXHIBITION.

economies. Later, Mr. Allison Smith acted as consulting engineer in connection with the designing and construction of the vast locomotive works for the railways of West Australia. Since his return to England he has brought out the automatic buffer-coupling, or A.B.C. system of automatic couplings, which he invented some years before, and which, having been taken up by a substantial syndicate, are now being tried in this country and elsewhere with very favourable results. Mr. Allison Smith is to leave England on December 3rd to enter upon his new duties.

International Gas Exhibition.

The International Gas Exhibition, opened a few days ago at Earl's Court, will be continued until the 17th prox. It represents the latest efforts made by engineers and scientists to utilise gas for lighting, cooking, and motive power. Lighting and motor exhibits are displayed in bewildering variety. Messrs. Graham, Morton, and Co. are showing the largest exhibit of elevating and conveying machinery that has yet been shown in motion. Two tons of coal are employed continuously for this demonstration, the details of which may be viewed from a bridge above. This interesting exhibit is shown in the above illustration by the courtesy of the Leeds firm.

Engineer Mayors.

In addition to the engineer mayors mentioned last week, we note the election of Mr. Robert Armitage,

director of the Farnley Iron Company, as Lord Mayor of Leeds, and Mr. Joseph Jonas, steel manufacturer, as Lord Mayor of Sheffield. Other mayoralties of special interest to engineers are those of Rotherham (Colonel Stoddart), Wakefield (Mr. H. S. Childe), Workington (Mr. R. E. Highton), Wolverhampton (Mr. R. E. W. Berrington), Newport, Pembroke (Mr. H. R. Felix), and Lewes (Mr. J. H. Every).

Mr. M. Palmer has resigned the secretaryship of the British Society of Mining Students. In future all communications should be addressed to Mr. W. Wrench Lee, of Queen's Chambers, 5, John Dalton Street, Manchester.

Awards.

Sir William Crookes, F.R.S., has been awarded the Copley medal by the Royal Society in recognition of his extensive researches into spectroscopic chemistry, electrical and mechanical phenomena in highly rarefied gases, radioactive phenomena, and other subjects. The Davy medal is awarded to Prof. W. H. Perkin, jun., for his discoveries in organic chemistry, and Sir J. W. Swan, F.R.S., whose biography appeared last week, gains the Hughes medal for his invention of the electric incandescent lamp and various improvements in the practical application of electricity. Prof. Ernest Rutherford, F.R.S., receives the Rumford medal for his researches into radio-activity.

N.E.R. STRAKER MOTOR WAGON.

THE wagon illustrated below has been recently designed for the North-Eastern Railway Company. It is capable of carrying 5 tons on the platform, will also haul a trailer loaded up to 2½ to 3 tons on level roads. It has been fitted by the Railway Company with hinged sides and ends to facilitate loading and unloading, and to enable it to deal advantageously with material in bulk, such as roadstone, loose potatoes, etc.

The weight of the wagon is carried on two points on the back axle, and one central pivot on the front axle, which construction prevents any twisting action being put upon the frames when the wagon is travelling over uneven ground.

The wagon is capable of an average speed of about seven miles an hour on level roads when running on the top gear; the low gear, which is used for climbing very steep hills, giving a speed of about four miles an hour.

This wagon is provided with a compound horizontal engine of the open type, fitted with a patent single eccentric valve motion, having cylinders 4 in. and 7 in. by 7 in. stroke, provision being made for admitting steam direct from the boiler to the low pressure-cylinder when extra power is required. A double sliding pinion is provided in the squared end of the crank shaft,

and this pinion gears with either of the two spur-wheels on the countershaft, thus giving two useful gear speeds and a free engine position. The final drive is by means of a compound chain from a small sprocket on the countershaft to a larger one on the back axle, which is of the live axle type, one wheel being fixed to the axle proper, and the other to a sleeve which is free to revolve on the axle itself.

The differential gear fitted between them provides for an equal turning effort being applied to each wheel, although they may be revolving at different speeds as when turning corners.

This terminal chain drive allows for the wagon riding up and down on its springs, and does away with the necessity for universal couplings, which are a weak feature in some wagons.

The boiler is of the water-tube type, and is built up of four concentric shells,

A large water tank is fitted at the back of the frame, and has a capacity for 140 gals., this amount of water being sufficient for a run of 17 miles with a 5-ton load in level country, and the coke bunkers have a capacity equal to 30 or 40 miles running.

The trailers are being built in the N.E.R. carriage shops, and are capable of carrying a load of 2½ to 3 tons.



18 FT. 6 IN. STRAKER MOTOR WAGON FOR THE NORTH-EASTERN RAILWAY.

THE DE LAVAL STEAM TURBINE.

(Continued from page 634.)

OTHER POINTS IN CONSTRUCTION.

ALL the bearings of the flexible shaft in this turbine, as well as the gear wheel, are lubricated from a central oil reservoir mounted upon the gear case; all other bearings are self-oiling. The bearings are made in two halves, so as to be easily taken out and examined.

The gear wheels are made of solid cast steel, or of cast iron with steel rims pressed on, the teeth in two rows being set at an angle of 90 deg. to each other.

The flexible shaft is mainly supported on each side of the pinion by main bearings Q and R, the shaft is at the same time made very slender, which gives it a certain amount of flexibility and allows the turbine wheel, when the so-called critical speed is reached, to revolve around its true centre of gravity. This critical speed, dependent upon the flexibility of the shaft, occurs well below the normal speed of the turbine, and marks the disappearance of all vibration.

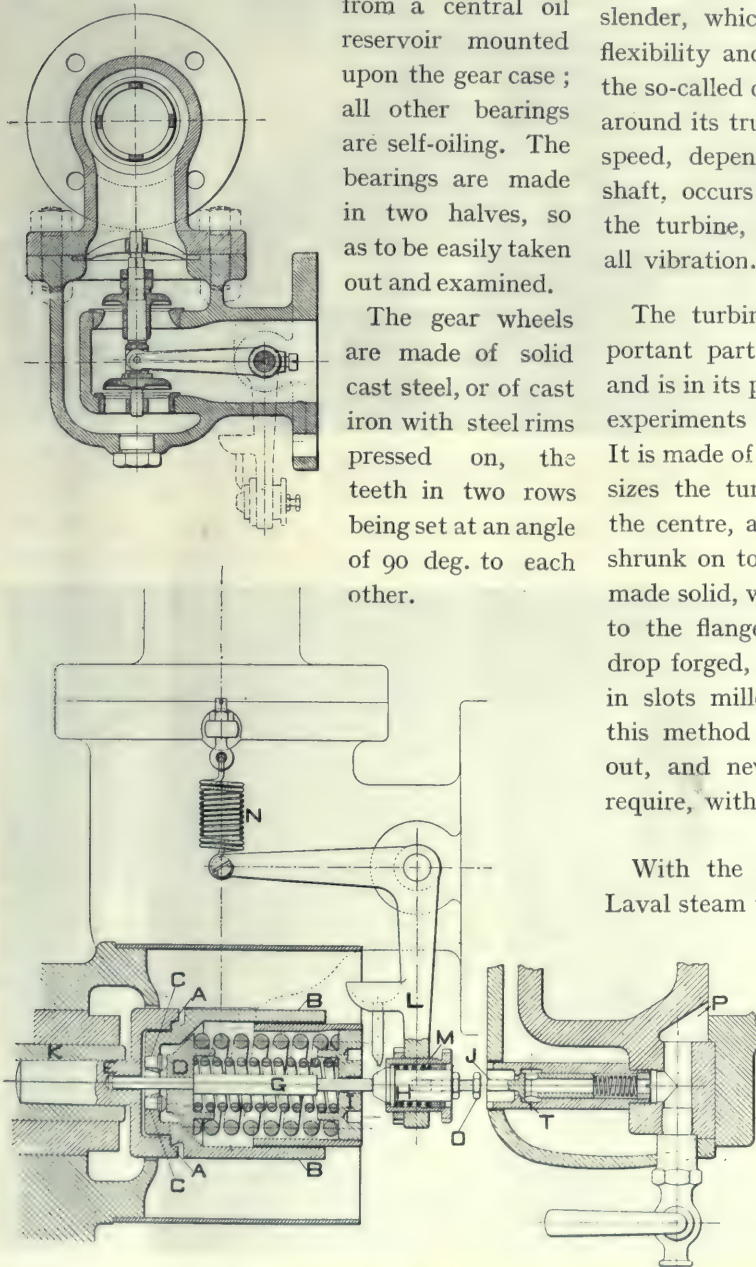
TURBINE WHEEL.

The turbine wheel is by far the most important part of the De Laval steam turbine, and is in its present form the result of numerous experiments both as to shape and material. It is made of forged nickel-steel. In the smaller sizes the turbine wheels have a hole through the centre, and are forced upon a taper sleeve shrunk on to the shaft. The larger wheels are made solid, with the shaft in two pieces screwed to the flange of the wheel. The buckets are drop forged, and made with a bulb shank fitted in slots milled in the rim of the wheel. By this method the buckets can easily be taken out, and new ones inserted, should occasion require, without damage to the wheel.

GOVERNOR.

With the high speed employed in the De Laval steam turbine a governor of small dimensions, and yet very effective,

can be used. The governor shown herewith in detail is compact and simple in construction. The two weights B are pivoted on knife edges A, with hardened pins C bearing on the spring seat D. E is the governor body, fitted in the end of the gear wheel shaft K, and has seats milled



DE LAVAL GOVERNOR AND VACUUM VALVE.



INSPECTING DEPARTMENT IN THE WORKS OF THE DE LAVAL STEAM TURBINE COMPANY AT TRENTON, N.J.



VIEW IN THE DRAWING OFFICE AT THE DE LAVAL WORKS.

for the knife edges A. It is afterwards reduced in diameter to pass inside of the weights, and is in its outer end threaded for the adjusting nut I, by means of which the spring and eventually the speed of the turbine is adjusted. When the speed exceeds the normal, the weights affected by the centrifugal force, spread apart, and, pressing on the spring seat D, push the governor pin G forward, cutting off part of the flow of steam.

The vacuum valve is only necessary when running condensing, as in this case it has been found that the governor valve alone is unable to hold the speed of the turbine within the desirable narrow limit during sudden and great changes in the load. The function of the vacuum valve is as follows:—

The governor pin G actuates the plunger H screwed into the bell-crank L, however, without moving the plunger relative to said crank. This is on account of the spring M being stiffer than the spring N, whose purpose is to keep the governor valve open and the plunger H in contact with the governor pin. When a large part of the load is suddenly thrown off, the governor opens, pushing the bell-crank in the direction of the vacuum valve T. This closes the governor valve, which is completely shut off when the bell crank is pushed so far forward that the screw O barely touches the valve stem J. If this is not sufficient to check the speed, the plunger H is pushed forward in the now stationary bell-crank, and opens the vacuum valve. This allows the air to rush into the space P, where the turbine wheel revolves, effectually checking its speed.

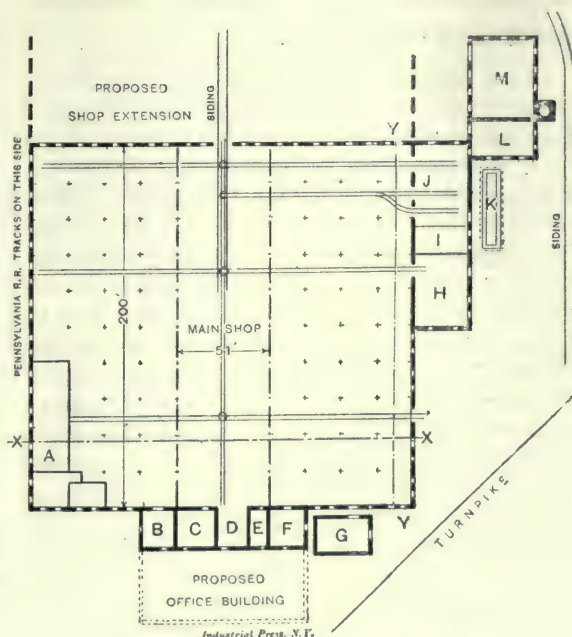
THE DE LAVAL SHOPS.

The De Laval shops at Trenton are about 200 ft. in length, with ample room for extension. A general idea of the lay-out will be obtained from the accompanying plans. They are excellently lighted, the roofs being of the saw tooth type, and are served by two sidings from the railway. The entire works are

electrically driven, power being supplied by a steam turbine unit of 200 k.w. capacity, which was turned out at the Swedish works. By courtesy of the De Laval Company we were enabled to give our readers last week some idea of the small lathe department, and small erecting shop. On the opposite page we reproduce a photo showing the interior of the testing room, where all turbine units are tested before shipment. This room is enclosed in order to guard against interruptions which might lead to errors or oversight on the part of the inspectors. On page 684 also appears a view of the drawing office, and in this connection we shall describe in our next issue an ingenious system employed in giving out the drawings. The illustrations on page 678 speak for themselves.

The interests of the De Laval turbine are watched over not only by the American and Swedish companies, but also by the Société de Laval at Paris and by Messrs. Greenwood and Batley, Ltd., at Leeds.

(To be continued.)



PLAN OF THE DE LAVAL WORKS.

LOCOMOTIVE NOTES.

An Apparent Anomaly.

It is not a little curious that the large majority of our railways should persist in the use of four-coupled tanks with relatively large wheels at a time when the six-coupled type is coming more into favour for fast express duty. No fewer than five of the leading British lines—the Great Western, the North Eastern, the Great Central, the Glasgow, and South Western, and the Caledonian railways—are going in for six-coupled expresses. Cross the Channel, and you will find the French Northern, Eastern, Western and Orleans lines using six-coupled engines on some of the best expresses, and in some cases the P.L.M., the Southern and the State Railways too. It may reasonably be anticipated one would imagine, therefore, that in view of its manifest advantage as regards most suburban traffic, the six-coupled plan will come more and more into use for tank engines working heavy suburban trains, and it is interesting to notice strong symptoms that this change in the practice of former days is steadily advancing and developing.

Mr. Whale's "Precursors."

I have recently had several very interesting experiences with one of the new and very fine "Precursor" type engines which Mr. G. Whale has provided for the heavy express service on the London and North-Western. One—an old friend, No. 1419, "Tamerlane"—ably driven by Hughes, took the 10.45 a.m. $3\frac{3}{4}$ hour express from Euston to Liverpool. This train is booked to do the $133\frac{1}{2}$ miles from London to Stafford in 142 minutes, averaging 56.4 miles an hour from start to stop. In spite of being badly checked approaching Stafford, "Tamerlane" performed the run in 138 min. 127 sec.—2 hrs. 18 min. 27 sec.—from dead start to dead stop, or in 2 hrs. 17 min. 29 sec. from platform to platform, while the net time, after allowing for the check, was 2 hrs. 16 min. Yet the load was no less than "18½" coaches, as officially computed, weighing 340 tons empty, or nearly 360 tons loaded behind the tender.

A Striking Metamorphosis.

But Mr. Whale is doing much more than to design and build efficient new engines. He has also started

on a course which means virtually doubling the efficiency of a large number of older—though not old—locomotives. It has always been a reproach to the four-cylinder compounds, designed and built by Mr. Webb between the years 1897 and 1903, that while they could haul huge loads if allowed to take their own time, they often showed themselves sluggish in point of speed, and thus frequently failed to keep a fast booked time with heavy loads. As a consequence, those latest locomotives of England's premier railway were daily and hourly seen with an assistant engine on loads that elsewhere were taken by one engine unaided, in as fast or faster booked time. From the outset many engineering critics had ventured to express the opinion that even apart from the smallness of their boilers, these engines were also grievously hampered through having a single cut-off for high and low pressure cylinders instead of having the separate cut-off to which the de Glehn compounds owed so much of their remarkable efficiency. Almost immediately after Mr. Whale succeeded to the Crewe chieftaincy he set himself to reverse this method. He first altered No. 1952 "Benbow," one of the later batch of four-cylinder compounds—Nos. 1941-1980—and tried it with a load of 372 tons over the $24\frac{1}{2}$ miles length each way.

Remarkable Results.

The outcome must have been somewhat startling to those who had not fully realised the potentialities of the alteration. Whereas with the old valve gear "Benbow" occupied $38\frac{1}{2}$ minutes in covering that distance of $24\frac{1}{2}$ miles, of which it took 22 minutes to climb the moderate bank from Crewe to Whitmore, $10\frac{1}{2}$ miles, 3 being at 1 in 177 and the rest at 1 in 330 to 1 in 250, with Mr. Whale's valve gear the same engine accomplished the same length in 33 minutes, and ascended the bank to Whitmore in $18\frac{1}{2}$ minutes. Relatively improved results were attained on the return trip. Practically the outcome of the change in the valve gear was that the engine averaged six miles an hour better speed each way, virtually the whole gain being uphill. But a much more notable illustration of the value of the change came under my own observation very recently. The midday express from Liverpool to Euston was

hauled from Rugby to Euston by one of these altered engines, No. 1941, "Alfred the Great." The load was reckoned as "24½ coaches," which, according to the official weight-list represented a total load behind the tender of 450 to 460 tons empty, or 470 to 480 tons including passengers, staff, baggage and stores. Let it be remembered that with the original valve-gear "Alfred the Great," required to take a pilot with anything over "17 coaches." With the new valve-gear giving a separate cut-off, the engine, unassisted, simply "walked away" with that vast train. Up the preliminary rise at 1 in 36½ from Rugby station to Kilsby tunnel, the speed persistently increased mile after mile until we entered the tunnel at 40 miles an hour, not having then by any means reached the possible maximum. Up the subsequent grade at 1 in 350 approaching Roade the speed did not go below 52.8 miles an hour, while up the final climb at 1 in 330 for six miles to Tring we maintained a constant minimum of 47.4. I have never seen that equalled—gradients, load and speeds all taken into account—by any engine, although of course I do not pretend to say that it could not be done. I only say that in all my large experience such has never come under my notice. The work on the level and downhill testified equally to the swiftness and free running of the engine, and those who know the London and North-Western Railway will promptly recognise, when I say that Bletchley was reached in 41 min. 30 sec., from the Rugby platform, and Willesden in 25 min. 19 sec., from Tring, how very smartly the engine must have performed, especially with such a monster load as 470 to 480 tons behind the tender. The Rugby-Willesden time, dead start to dead stop, was 85 min. 42 sec., from platform to platform 84 min. 40 sec., the booked time being 90 minutes.

The North-Eastern Atlantics.

Mr. Worsdell continues to increase the number of his colossal "Atlantics." At Newcastle a few days ago, I saw Nos. 742, 1748 and 1792, all of which replace old locomotives of perhaps one-third their power. Probably I should not be far wrong if I stated that those three new Atlantics are equivalent to ten of the old engines. They are magnificent in aspect and must possess a vast reserve or margin of power. At the present winter season, of course, they have no loads worthy of their capacity. They simply play with the trains they have to work. Thus on the 11.8 fast express from Newcastle, which is

allowed 2 hr. 22 min. for the 124½ miles thence to Edinburgh, averaging 52.5 miles an hour, No. 1792, with a load of 250 tons behind the tender, ran easily in front of booked time all the way, passing Berwick, 67 miles, in 70 min. 12 sec.—notwithstanding bad fog for the first 20 miles—and reached Edinburgh, 57½ miles, in 65 min. 49 sec., thence, or in 136 min. 1 sec. from Newcastle, six minutes (less one second) under time, although a delay of 3 minutes was experienced through two bad permanent way slowings between Longniddry and Inveresk. In the opposite direction No. 742 with 300 tons, ran from Edinburgh to Berwick in 71 min. 17 sec., start to stop, i.e., 3 min. 43 sec. under booked time, and Berwick to Newcastle, in 76 min. 38 sec., or 6 min. 22 sec. under schedule time. And I saw no reason to doubt that each engine could have taken 50 per cent. greater load with equal punctuality. We shall see more British Atlantics built yet. The type has come to stay.

Miscellaneous Notes.

An order has been given by the Great Western Railway to the Société Alsacienne for two more du Bousquet-de Glehn compound express engines of the Atlantic type, of the same general design as "La France," but of much larger dimensions, those of the Paris-Orleans set being in fact taken as the basis. The new engines are to have 2,616 square feet of heating surface, and will weigh no less than 73 tons each, exclusive of tender, or 8 tons more than "La France." They are to be ready for next summer's traffic. Mr. Drummond has completed his batch of ten new express engines for the London and South Western, which are of his "702" standard design, but have larger boilers.

I have to note with deep regret—personal as well as professional—the death of Mr. R. J. Billinton locomotive superintendent of the L. B. and S. Coast line. I hear that he is to be succeeded by Mr. Marsh, Great Northern Works Manager at Doncaster, a very satisfactory selection.

A rumour reaches me that the Great Northern Railway has ordered a four-cylinder compound of the du Bousquet-de Glehn design. If so, we may see some very interesting competitive trials. Four more engines of the "County" class are out on the Great Western Railway; they are numbered 3478–3481 inclusive and are named respectively after the counties of Devon, Warwick, Stafford and Glamorgan.

OUR WEEKLY BIOGRAPHY.

PROFESSOR HENRY LOUIS, M.A., A.R.S.M., F.I.C., F.G.S., M.M.S., etc.,
Professor of Mining, The Armstrong College, Newcastle-on-Tyne.



Photo by Maull and Fox.

PROFESSOR HENRY LOUIS is a native of London. Born in 1855, he was sent at an early age to Bavaria, where he received his primary education. When he was nine years of age he returned to London, and, evincing a decided tendency for scientific pursuits, was enrolled at the City of London School. The record of his student days recounts a series of notable successes; while at the above school under the headmastership of Dr. E. A. Abbott, he won medals for French, German, and Science, and for general proficiency he obtained the William Tite Scholarship, and the David Salomons Foundation

Scholarship. For Science he secured the Mortimer Exhibition. He was also the recipient of a number of other awards from the Science and Art Department, the most important being one of the Royal Exhibitions tenable at the Royal School of Mines, which institution he entered at the age of eighteen. Here he continued to make remarkable progress; at the end of the first year he obtained the First Royal Scholarship; twelve months later, the Duke of Cornwall's Scholarship, and at the conclusion of the three years' course, having secured foremost place in Mining and Metallurgy, he received in addition to the Associateship of the School, the De la Beche Medal.

His first appointment was in the laboratory of Dr. J. Percy, where he was engaged in conducting researches on the metallurgy of silver. The following year, having attained his majority, Mr. Louis was appointed by Sir C. W. Siemens as chemist to the Steel Company of Canada, Londonderry, Nova Scotia.

After he had accomplished a vast amount of mineralogical work in Nova Scotia, Mr. Louis made an extended tour through the coal and iron regions of the Eastern States of America; then, returning to England he conducted for Sir C. W. Siemens, a series of experiments on open-hearth steel making at Landore. He was next appointed to a large foundry in Scotland, where he built a special testing machine and laboratory.

In 1880 he spent a short time in lecturing on Metallurgy at the Medical School of the London Dental Hospital. He subsequently accepted an appointment in Ecuador, South America, as assistant manager and assayer to a gold mine. Mr. Louis spent a short period in hydraulic gold mining in Columbia, then returned to Europe, and having gained further experience in different countries, in 1883 he again went abroad as reduction officer and manager to a mine on the Gold Coast.

Two years later he returned to this country, but shortly afterwards went to the Transvaal,

and it may be noted that Mr. Henry Louis was one of the pioneers to examine and prove some of the coal seams in the Transvaal. Between the years 1885-1890 he journeyed four times to South Africa, and during one interval he spent some time in gold mining in California.

The year 1890 found Mr. Louis in Singapore, where, in conjunction with Mr. H. M. Becher, he founded the firm of Messrs. Becher, Louis and Co. For about four years he acted as consulting engineer, manager, and mining engineer of various mines in the Malay Peninsula, Siam, and Borneo; he travelled extensively, visiting mining properties throughout Siam, India, Tonquin, and the Peninsular.

In 1894 Mr. Louis undertook the management of an iron ore mine in Spain, remaining in that position until 1895, when he was elected to occupy the Chair of Mining in the Durham College of Science, now the Armstrong College, Newcastle-on-Tyne. In addition to the duties attached to the Professorship he also lectures on Metallurgy.

An excellent linguist, and the author of several well-known and reliable technical works, Professor Louis is also a frequent contributor to the Transactions of various learned societies. He is member of the Iron and Steel Institute, the Institute of Mining Engineers, the Institution of Mining and Metallurgy, also Fellow of the Geological Society, the Mineralogical Society, and Institution of Chemistry, and has been a member of the Board of Studies of London University in Mining and Metallurgy from the beginning. He has acted as External Examiner in Mining for the University of Wales, Examiner in Mine Surveying and the Raising and Reparation of ores to the City and Guilds of London Institute. In 1902 he was appointed Special Commissioner by the Colonial Office to investigate the Pitch Lake of Trinidad. His recent work has included reports on mineral deposits in India, Algeria, and Canada.

POWER STATION NOTES.

By E. KILBURN SCOTT, M.I.E.E.

Super Heat and Design.

The introduction of high super heat for engine working will undoubtedly lead to modifications in engine design in the direction of doing away with irregular-shaped valves and flanges, etc. The one good feature about high super heat in connection with valve design is that there is very much less chance of cutting. For example, it is surprising what an amount of cutting can be caused on an ordinary stop valve with saturated steam. It appears to occur just at the point of opening and closing when the steam has high velocity and simply by getting rid of the moisture the cutting practically disappears. This is one reason why super heat is such an advantage in steam turbines.

Carbon-Dioxide Recorders.

With ordinary thin fires and open grates, smoke can only be prevented by using excess of air, but this is fatal to economy, as so much of the heat that should be transferred to the boiler then goes to waste.

The amount of carbon-dioxide gas passing up the chimney is perhaps the best guide as to whether the fuel is being economically used, and consequently the carbon-dioxide recorder is being employed in many of the larger power stations. It is estimated that if carbon dioxide can be raised from 7 to 14 per cent. there will be a saving of fuel of about 15 per cent.

Anchor Ice.

In harnessing large water powers for electrical purposes, a number of problems have to be met with which the engineers of this country have little or no experience. For example, one of the greatest difficulties on Canadian rivers, is what is called "anchor ice." These formations of ice are met with on the rapids at certain periods of the year and they may stop a generating plant for as long as 12 hours. Anchor ice is of a pulpy, gelatinous character, which forms on the rocks and floats just underneath the surface. In a few hours the turbines may become full of this material, there is then nothing for it but to stop the plant and shovel it out like so much snow.

Ordering Spare Parts.

In deciding upon the spare parts to be ordered with a new plant one is confronted with a rather delicate financial problem. Clearly if a large number

of spare parts are ordered the initial outlay will be considerably increased and there is a larger capitalisation on which to earn a profit. On the other hand if few or no spare parts are ordered then when they become necessary their cost comes against raising costs, and it is conceivable a few fat years may be succeeded by a very lean one in the event of there being a bad breakdown. It is a nice question for the engineer to decide and it is to be feared that in too many cases the shortsighted view is taken of not getting enough spares when the plant is first installed. When the engineer is only going to be responsible for a short time after it is started it is easy to see that this is the point of view he will have; whereas, an engineer who is going to be responsible for the plant for a number of years will want a number of spares to draw upon as time goes on.

There is no doubt that a conscientious engineer will be liberal in ordering spares and not merely be content to limit the list to a set of springs and a set of brasses as so many do.

The Starting of Large Gas Engines.

Although the starting of gas engines is much better than it used to be it is hardly as satisfactory as it should be. There are three ways in which it may be effected: (a) By a small compressed air engine fed from a compressor; (b) By a small steam engine, the steam being supplied at 60 lb. or so from the gas producer, and (c) By running the electric generator round temporarily as a motor. The disadvantage of the compressed air engine is that the air may leak out through the glands of the compressor; whilst in the case of the steam engine this of course depends on whether a gas producer is being employed and the design of same. As for the electric generator method this can be done if the generator is for direct current and a supply of electricity is available, but it is impossible if the generating gives alternating current.

Of the three methods, the small steam engine is perhaps the best, and that is why one is justified in saying that the starting of large gas engines cannot be considered satisfactory. The ideal heat engine would be one that could dispense with steam just as the ideal motor-car is one that does not require a horse to drag it home occasionally.

QUESTIONS OF THE DAY.

III.—The National Encouragement of the British Inventor: How Can it be Secured?

This discussion, opened by Mr. B. H. Thwaite, C.E., in No. 7 of PAGE'S WEEKLY, is continued from page 639, and will be continued in subsequent numbers.—ED.

THE LIMITATIONS OF THE NEW ACT.

Sunbridge Chambers,
Bradford.

To the Editor of PAGE'S WEEKLY.

SIR,—In reference to the above. The new Act is, no doubt, a step in the right direction, in as much as inventors will obtain better protection than hitherto, but it is to be regretted that the Comptroller has not the power to absolutely refuse the grant of a patent in the case of undoubted anticipations, as if applications are filed under present conditions, references only as to prior specifications are inserted, the patent, when granted, may not be worth the paper it is written on.

With regard to renewal fees, these, I think, too high for the ordinary run of inventions, and could very well be reduced. It is not necessary for the Exchequer to make a profit out of struggling inventors. Still, if an invention is doing well, the inventor ought to pay something to the Exchequer, *i.e.*, the renewal fees.

As to the length of time a patent should run, it would be only fair to British inventors that the time should be equal to that of foreign countries, namely seventeen years, but for foreign inventors the conditions should be as now appertain to inventors in the majority of countries abroad, namely, the patent should lapse at the same time as the first previous foreign patent. If an invention is an important one, and the term of years, according to our laws, not sufficient to enable the inventor to adequately remunerate himself, then such time should be extended, as is now provided.

With regard to the working of inventions in this country, it is only natural that a British inventor will work a successful invention in his own country, but with regard to a foreigner (this term does not include our colonists) this is different, and, as our laws are at present constituted, he could flood the market with cheap foreign made articles. He should be made to work the invention (apart from the granting of licenses) in Great Britain, and obtain a certificate of working, and unless such working takes place, his patent should lapse, that is to say, I would treat the foreigner just as British inventors are treated now in foreign countries.

I do not think it advisable that our Patent Department should offer prizes for the encouragement of

inventors. For this reason that intending inventors might be tempted to apply for patents which possessed no real subject-matter, and thereby waste their money, whilst the Exchequer would materially benefit, and the poor inventor would, indirectly, be paying for the prizes.

With regard to the Official Search, I admit that it is a step in the right direction, but it does not go half far enough. It will give the inventor knowledge of inventions patented fifty years previous to his application, but what about pending provisionals, covering a period of six months immediately before his application—by far the most important period. He cannot obtain any knowledge of inventions filed in such time.

Again, how does a Provisional Application protect an inventor? As to date—you say—quite so; but how does he benefit? Suppose he puts his invention (a small article) on sale before he files his complete, any unscrupulous person may make and sell, and he the inventor, has no remedy. He may only take action for infringement when he has obtained his full patent, three months at least after the filing of his complete, and then only as to infringements which have taken place after such grant. What damage can be done in the nine months, providing he left the filing of his complete to the last moment, one cannot judge, but all experience would seem to justify the abolition of provisional protection. This, in turn, would abolish the filing of applications for many worthless and old inventions, and give greater protection to true inventors.

The point has been raised that our judges have not enough practical knowledge to judge the merits or otherwise of an invention, and that a special tribunal of technically and legally-trained experts should be formed. I do not agree with this entirely, as I am of opinion that some of our judges are quite capable of tackling any case, but a Patent Court might be established with selected judges, appeal from their decision to be sent direct to the House of Lords, who have hitherto never failed to put a liberal interpretation upon all specifications, which cover undoubted inventions, thus saving the costs of the Appeal Court.

Yours faithfully,

CLIVE T. WAUGH,

Fellow of the Chartered Institute of Patent Agents

AN ENGINEER'S OPINION.

75, Victoria Road,
Headingley, Leeds.

To the Editor of PAGE'S WEEKLY.

SIR,—The efforts you have inaugurated for the national encouragement of the British inventor are worthy of all praise, and I trust will awaken national interest in all quarters, irrespective of party and sectional class interests, which, to me, appear too much to dominate our public affairs, and especially our domestic and commercial legislation.

The question of patent laws and their bearing on national industry in a manufacturing community like ours, it must be clear to all unprejudiced thinkers on national progress, is a complex and difficult one; and while everyone must agree that our present system is very far from perfection, and that improvements should be made therein with a view to stimulate to the highest degree, first, the exertions of native skill in invention, and, after, the benefit to this country and people, of foreign ideas, it is not at all easy to lay down positively the direction in which changes should be made so that none but beneficial effects should result therefrom.

The writer is of opinion that the Britisher is too apt, when aroused out of his common lethargy and *laissez faire*, to magnify his own defects, and unduly to look on the methods of other nations as in every way superior to our own, and while he would not close his eyes to what may be good and adaptable to our needs, as exemplified in foreign practice, he would have it remembered that we cannot make any real progress by being merely copyists, but must thrash out our own problems and adopt such measures as are really suitable to our particular needs and conditions, after having as far as possible carefully examined the question from every point of view. Attention has been called to the difference between the cost of American and English patents, which, on the face of it, appear enormous, but on examination it is not nearly so great, for the practice of the American Patent Office in insisting rigidly on the rule of "one invention, one patent" causes a greater number to be taken out for the covering of the same invention in the U.S.A. than in England, probably in about the proportion of one to four. This would make the average cost of an English patent for the whole term of fourteen years to be three times instead of twelve or thirteen times that of a U.S. patent. A clear case seems to be made out that there should be some reduction of these fees, but the writer has not come across any definite instances in which our existing patent regulations have strangled a valuable invention, and, on the other hand, there may

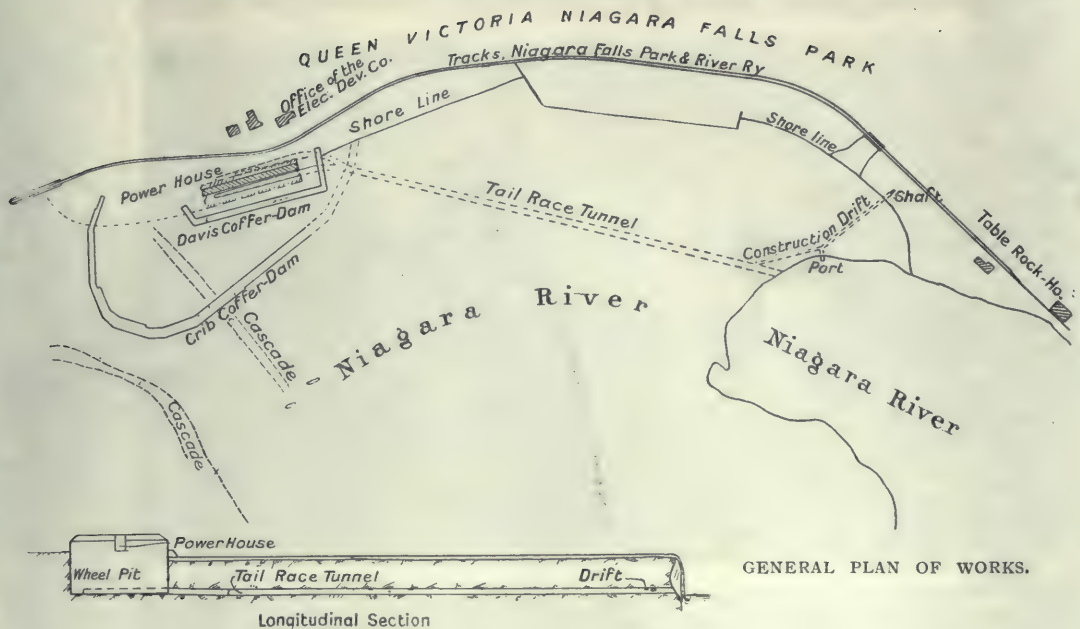
be some advantage to inventors in the natural killing off of patents for crude and imperfect invention which yield no return to their owners, and may simply act to block the way of others with more advanced ideas.

While advocating an ultimate and early reduction of patent fees, it is held that this should not be immediate to the inventor, but, instead, that the Exchequer should not absorb the annual surplus as at present, but spend it for the benefit of the inventor in making our Patent Office as complete, commodious, convenient, and up-to-date as possible; more perfect, if it may be, than that of any other country, and not starved, as now. The loss to our Exchequer of the sum of £100,000 per annum is comparatively too small to be seriously felt, and its expenditure on our Patent Office for two or three years should suffice to put it on a proper footing, after which a scheme might be brought into operation for the lowering or reduction of the renewal fees in an equitable manner, from the surplus profits, by a species of sliding scale arrangements which should not be difficult of achievement.

One matter in which the law should be amended, which is imperative, is that the foreigner should be prevented from locking up and preventing the working in this country of an invention while importing goods made under its monopoly from abroad. Of course it will be said that this is directly opposed to our present fiscal, so-called free trade, policy, but the patent law is a beneficial and necessary monopoly, and the said policy is entirely out of place and illogical as applied thereto. The most useful and proper system to be adopted is reciprocity—applied in such a way as to bring patent law into line internationally as far as possible and so as to place all countries, so far as we are concerned, on equal competing lines commercially. The law should be made so that whenever it be required, compulsory working or some satisfactory arrangement of this nature should be obtainable in this country as a right, without entailing heavy legal expenses or costly delay, under forfeiture of the patent as a penalty, and where any restrictions on the English patentee are exacted in a foreign country other than those he is subjected to at home, let similar restrictions apply here to patentees from that country, so that all may compete on an equal footing.

Most of the suggestions made by Mr. Thwaite in a recent issue are worthy of very careful consideration, but would appear in many instances to be extremely difficult of realisation, and in some, possibly open to some objections and dangers in working, although, without doubt, the objects aimed at are very desirable.

J. T. PULLON, A.M.Inst.C.E., M.Am.I.M.E.



125,000 H.P. ELECTRICAL PLANT AT NIAGARA.

PROGRESS OF THE WORKS.

ONE of the most remarkable engineering schemes in progress at the present time is that which the Electrical Development Company of Ontario are carrying out at Niagara, for the Toronto and Niagara Power Company. The result, we are assured, will be one of the most modern and best-equipped power plants yet constructed. The company expects to develop 125,000 h.p. of electrical energy by the aid of the Niagara rapids, and, in order to supply Toronto, a private right-of-way, with a minimum width of 80 ft., has already been secured. The company at the same time has had an eye to the construction of a double track line of railway, as well as the placing of poles for the transmission cables. The right-of-way has been surveyed from Tempest Point to Scarlett Road, Lambton, a distance of $75\frac{1}{2}$ miles, and is being staked out and fenced in as rapidly as possible. At Lambton between fifty and sixty acres of land have been purchased for terminal purposes.

Six hundred acres of land have been acquired in the township of Stamford, running along the north bank of the Welland River for a mile and a half, for manufacturing sites. This property is two miles from Tempest Point, three miles from Niagara Falls town, and very convenient as regards railways facilities.

THE COFFER DAM.

Of the difficult tasks undertaken by the engineers at Niagara, the most formidable was, undoubtedly, the building of the crib-work coffer dam, within which to carry on the work of construction. A contract was given to Barry and McMordie, of Niagara Falls, Ont., and the first crib was put in place early in April, 1903. For four hundred yards from the shore the work was comparatively easy, and the cribs were built into place, but when the work got out to a point at which it had to be carried on at right angles to deep water, flowing at a high velocity, progress was made with the greatest difficulty. A platform was suspended out for 16 ft. from the end of each last crib, and standing on this the engineers had to sound every inch of the river bottom, the cribs being built to fit afterwards. To break the force of the current, a fender of heavy timbers, held in position by three steel cables from some works higher up the river, projected out beyond the last crib. It was twice carried away by the force of the current.

The space enclosed by the coffer dam, and since unwatered, was about twelve acres in extent, the dam being some 2,150 ft. in length, and from 20 ft. to 46 ft wide. At the deepest point at the upper corner



PROGRESS OF THE WORKS AT NIAGARA (*continued*).

(1) The main coffer dam just below the second cascade. Construction was both difficult and dangerous. The depth of water at this point is about 19 ft. The width of the main crib is 24 ft., with a reinforcement crib of 16 ft. separated by a clay puddle space of 6 ft.

(2) A view showing cascade and launching of a crib. It was at this point that the only fatal accident during the construction of the crib occurred; one of the workmen who fell into the river being carried over the falls.



PROGRESS OF THE WORKS AT NIAGARA (*continued*).

(1) Bull-nose of gathering dam. This dam will be entirely submerged, but will act as a huge arm to draw the water into the wheel-pit. It will change the water at this point into a poud condition, and will also raise its level considerably. The bull-nose is of granite, and the dam of concrete construction with granite coping.

(2) Flashlight photograph of portal end of tunnel showing timbering, etc. The boarding of the portal was found necessary on account of the heavy spray encountered by the contractors while dumping the excavated rock behind the falls.

where the main force of the torrent strikes the dam, it) is in 24 ft. of water. For a considerable distance this section consists of 24 ft. of crib-work, reinforced back of the puddle space by 16 ft. of crib-work. The puddle space, extending all the way round, is 5 ft. and 6 ft. wide, and effectively keeps the water out. The amount of leakage is very small. So well has the dam

been built that not a tremor can be felt when walking along it.

Huge boulders and great layers of rock lie on the river bed, which is also so badly fissured that it appears marvellous that a coffer dam could ever have been placed successfully on such a rough, scarred foundation, and in face of such perils. That the work was done successfully is a testimony to the ability of Mr. Hugh L. Cooper, the chief hydraulic engineer, and Mr. Beverley R. Value, the resident engineer.

THE WHEEL-PIT.

About 2,000 ft. above the crest of the Fall an immense hole has been sunk into the solid rock for the wheel-pit, which will be 416 ft. long by 25 ft. wide. When completed the bottom, on which the turbines will rest, will be 150 ft. below the original surface, and the two branch tail-races will be 8 or 10 ft. lower. The contractor had to build a subsidiary coffer dam around this work, and was thus enabled to start the excavation long before the main was completed.

GENERATING PLANT.

The eleven generators provided for in the complete plans will be installed on masonry foundations at the level of the power-house floor, and the connection between the generators and the turbines at the bottom of the wheel-pit will be made by the use of a hollow shaft, travelling in a vertical position, and having a total length of approximately 115 ft., supported at three intermediate points by solid masonry bearings.

The two elements in the wheel-pit of placing the labour of supporting all this machinery upon solid rock foundations, and the provision of masonry intermediate supports for the shafting, are a departure from previous practice, but have been adopted in order that the serious element of vibration in heavy revolving machinery may be reduced to an absolute minimum, and the expense of upkeep thereby have its proportionate reduction.

THE TUNNELLING OPERATIONS.

The water, after the performance of its labour in the turbines, will be discharged through steel draft tubes of two branch tail-race tunnels, connecting with the upper end of the main tail-race tunnel. This design is also a departure from previous practice. By the use of the two branch tail-race tunnels, it will be possible at any time to close down one-half of the station and make any necessary repairs without the other half of the station being interfered with. Its design will permit of weekly examinations of each half of the station at nights, and at any time when the loads are such that one-half of the station can carry them.

(To be continued.)



STEEL TOWER FOR TRANSMISSION LINE.

These towers are being erected every 300 ft. to 400 ft. along the eighty-mile Right of Way owned by the Company.—2,800 towers in all

PORTABLE STEAM ENGINES OF TO-DAY.

BY

J. C. R. ADAMS.

The following article is continued from No. 10. The previous articles of the series, devoted to a theoretical and practical consideration of single-cylinder locomobiles, will be found in the July, August, and September issues. PAGE'S WEEKLY was commenced on October 14, 1904.—ED.

VII.



WE have already illustrated a very large compound portable engine by Messrs. Robey and Co., Ltd., Lincoln, who are specialists in this class of work, and now supplement this by a view of their compound engine as made in the ordinary sizes. (Fig. 12.)

In this engine, as in Messrs. Robey's single and double cylinder portable, the detachable principle is thoroughly carried out, the cylinder and crank-shaft plummer blocks being mounted upon flanged steel brackets riveted to the boiler and tied by steel stay-rods, the plummer-blocks being, of course, capable of sliding on their seat to accommodate the varying length of the boiler.

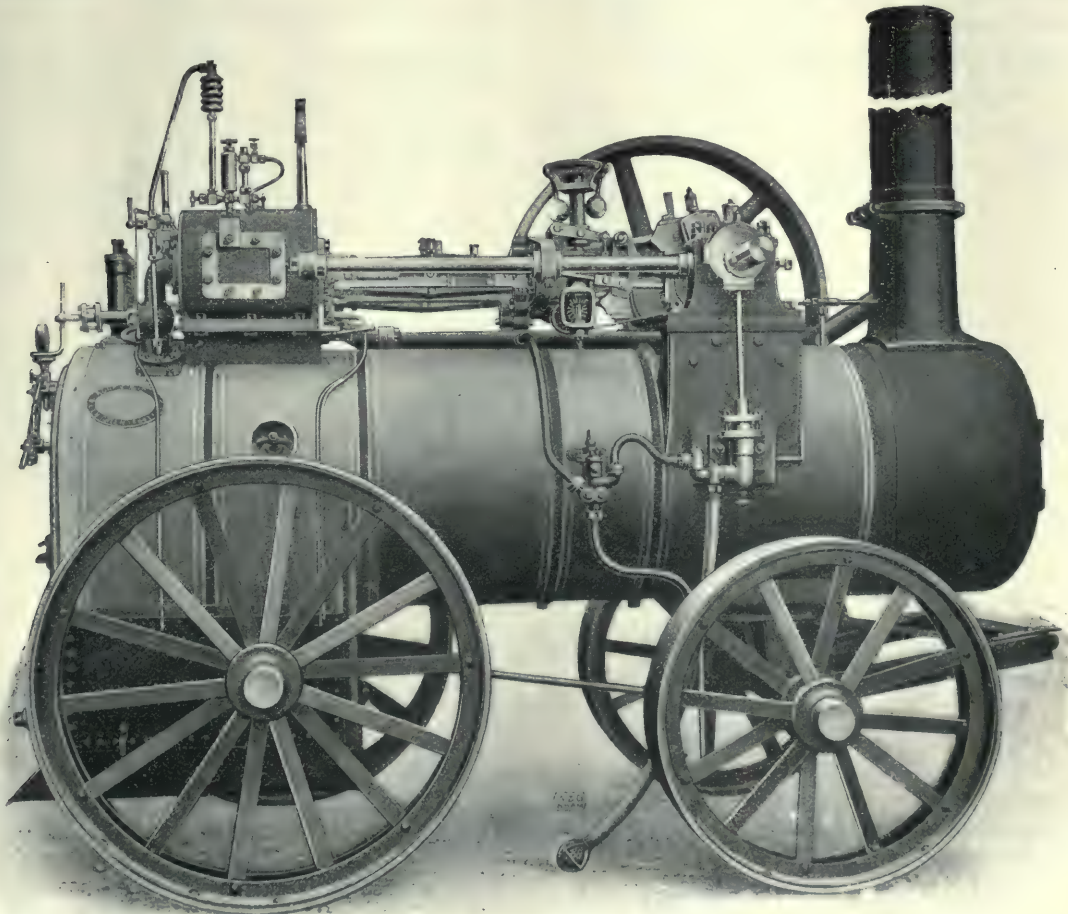
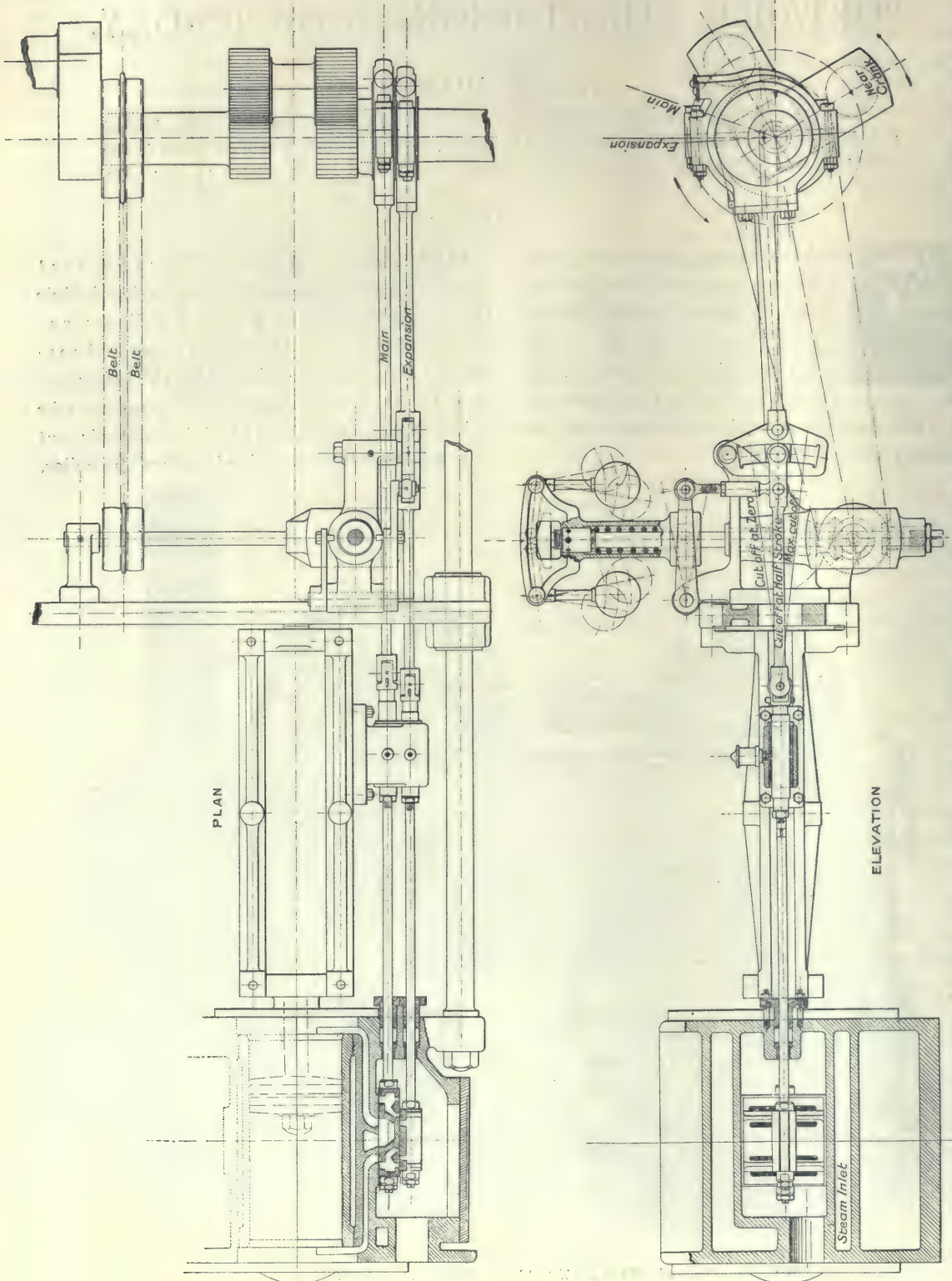


FIG. 12. MESSRS. ROBEY AND CO.'S COMPOUND PORTABLE ENGINE.



FIGS. 13 AND 14. PLAN AND ELEVATION OF MESSRS. ROBEY AND CO.'S AUTOMATIC EXPANSION GEAR, AS APPLIED TO A COMPOUND PORTABLE ENGINE.

Trunk guides do not appear to be favoured by Messrs. Robey, neither do I observe a central bearing for the crank-shaft. On the other hand I am glad to see that the crank webs are fitted with counter balance weights—a very necessary adjunct to the portable compound engine.

Many quick running engines of this class are anything but steady, in spite of all attempts to remedy matters by wedging or blocking the wheels, and the addition of counter-balances is a move in the right direction.

Messrs. Robey and Co. have furnished us with very clear and almost self-explanatory drawings of their automatic expansion gear, as applied to a compound portable engine, which consists of a belt-driven high speed governor capable of varying according to the load the position of a die, connected to the expansion valve by a radius-rod, in the swinging link clearly seen in fig. 13. The construction of the double-ported main and expansion slide valves is also very evident in fig. 14. This is a very simple and well-arranged expansion gear, and the combined high and low pressure cards taken from one of their engines shown in fig. 15 are

convincing testimony of its efficiency in action. Messrs. Robey's dimension table is annexed.

Horse-Power.		Cylinders.		Stroke,	Revs. per min.	Total weight cwt.
Nominal.	Effective.	H.P.	L.P.			
8	19-26	5½	9½	12	200	110
10	24-32	6	10½	14	172	135
12	28-38	6½	11½	14	172	150
16	38-51	7½	13	16	150	190
20	48-64	8½	14½	16	150	220
25	60-80	9½	16½	18	133	280
30	72-96	10½	18	18	133	310
35	84-111	11½	19½	20	120	400
40	96-130	12	21	24	100	490
50	120-160	13½	23	24	100	850

This cylinder ratio is 3 to 1, and the working pressure is 140 lb. to 150 lb. The margin of effective horse-power available beyond the normal or economical load is approximately 33½ per cent. It will be seen that Messrs. Robey and Co. go in for a higher rotational speed and a larger cylinder ratio than their competitors adopt, and that their margin or reserve of effective power is also greater than that tabulated by the other manufacturers of the same type of engine.

(To be continued.)

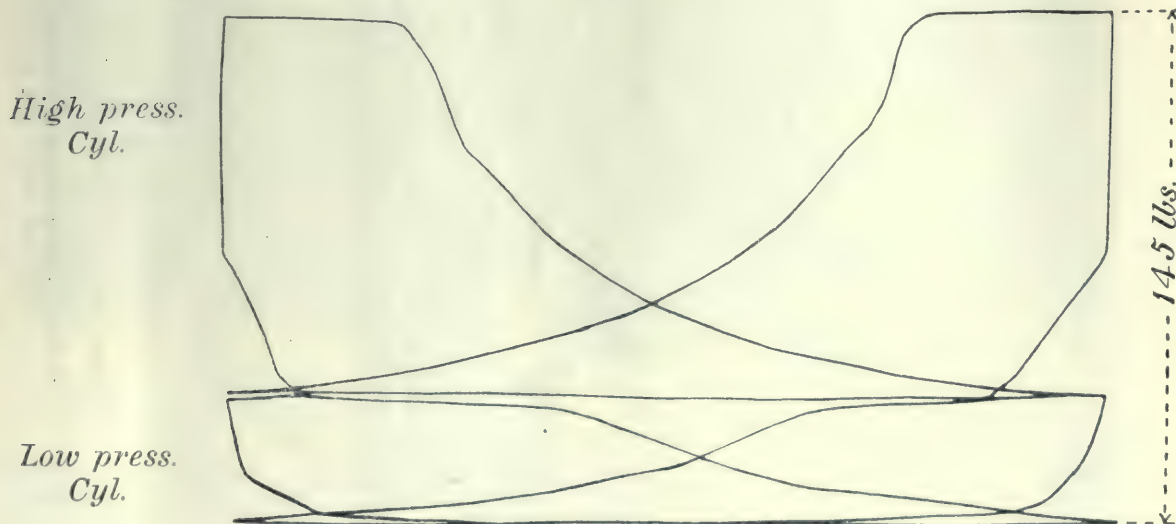
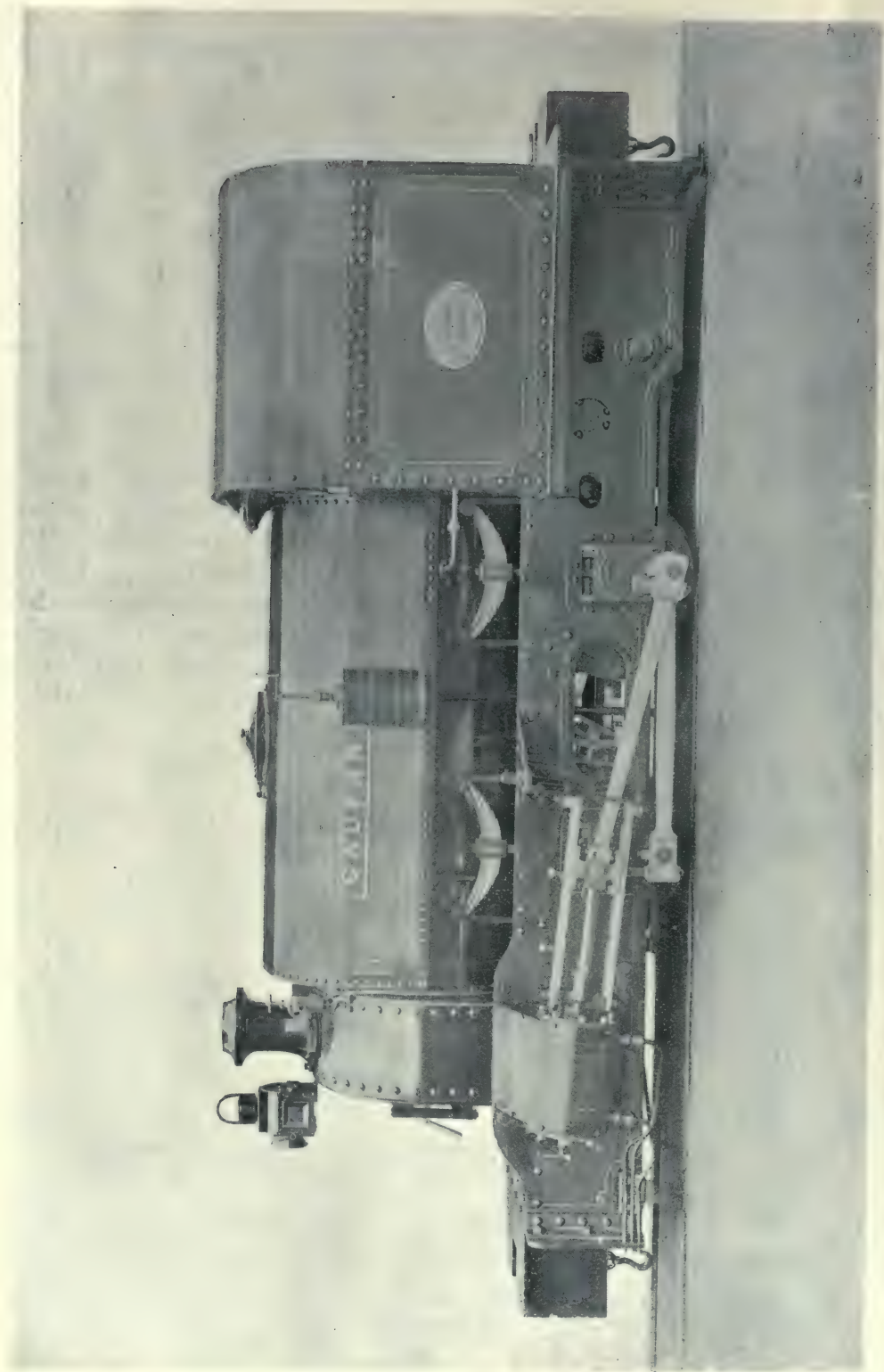
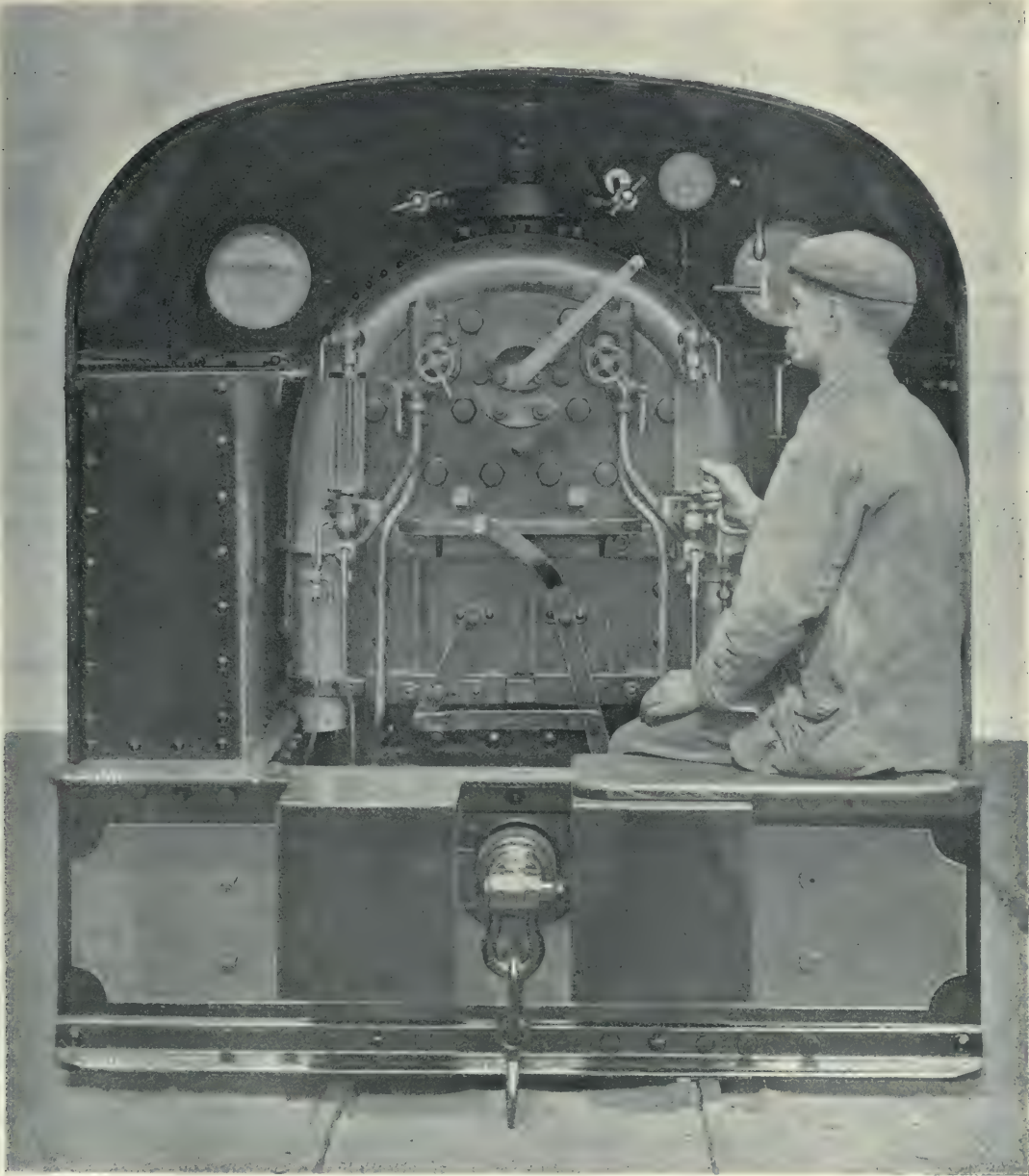


FIG. 15. COMBINED HIGH AND LOW PRESSURE DIAGRAMS FROM ONE OF MESSRS. ROBEY AND CO.'S COMPOUND PORTABLE ENGINES.



THE SADDLE TANK LOCOMOTIVE "CADFAN," BY THE HUNSLET ENGINE COMPANY, LTD., OF LEEDS.

This small engine was specially built for use in a quarry. A difficult tunnel had to be negotiated, so that the designers were strictly tied as to height and width. The dimensions of the "Cadian" will be found on the opposite page.



THE SADDLE-TANK LOCOMOTIVE "CADFAN"—VIEW OF ENGINE CAB.

The engine was specially constructed by the Hunslet Engine Company, Ltd., to work in a tunnel 6ft. 2in. wide by 6ft. high above rails. The dimensions are as follows :—

Gauge of railway	1 ft. 11 in.	HEATING SURFACE.	
Diameter of cylinders	7 in.	28 Brass tubes, 1 $\frac{3}{4}$ in. outside diameter	86 sq. ft.
Length of stroke	10 in.	Copper fire-box (above bars)	14 sq. ft.
Diameter of coupled wheels	1 ft. 8 in.	Total heating surface... ..	100 sq. ft.
Length of boiler barrel	3 ft. 3 in.		
Length of wheel base	6 ft.		
Diameter of boiler barrel	1 ft. 11 $\frac{1}{4}$ in.	Area of fire grate	2 $\frac{1}{2}$ sq. ft.
Capacity of water tank	110 gallons.	Weight of engine in full working order	6 tons 18 cwt.
Capacity of fuel space	4 cub. ft.	Weight of engine empty	6 tons
Working pressure	140 lb. per sq. in.		
Tractive force at periphery of wheels	2,450 lb.		
Extreme width	5 ft. 1 in.		
Extreme height above rails	5 ft. 9 in.		

DIRECT AND SINGLE-PHASE ELECTRIFICATION.

A COMPARISON.



CONTRIBUTION on this subject was recently read before the students' section of Electrical Engineers at Manchester, by Mr. F. O. Mills.

The author institutes a comparison between direct and single-phase electrification of the following theoretical system. The length of the line (Fig. 1) is 100 miles, with a large town at each end, and one in the middle. There are four tracks, two main line and two local. Main line trains run every half hour at an average speed of fifty miles, maximum sixty, giving eight trains on the up and down lines, for which power has to be provided. If each train weighs 100 tons and the train resistance is taken at 40 lb. per ton, the following is the h.p. per train:—

$$\text{h.p.} = \frac{40 \text{ by } 100 \text{ by } 88}{55} = 640 \text{ h.p.}$$

which, on the basis of eight trains gives 3,820 kilowatts to be supplied to the train wheels, and with an efficiency of 84 per cent., 4,550 kilowatts is required to be delivered at the third rail or trolley line. From the three main towns, "A," "B," and "C," for the first five miles, stations are half a mile apart; for the second five miles, one mile; and for the third section up to twenty-five miles, from "A," "B," or "C," the stations are two miles apart, that is, twenty-two stations in all from "A," "B," or "C" to twenty-five miles out.

There is a five-minute service up to five miles from "A," "B," and "C," a ten-minute service up to ten miles, and from "A," "B," and "C," one train every fifteen minutes stopping at all stations up to twenty-five miles. The maximum number of trains on first five-mile section at one time is twenty-four, and as the h.p. per train is 415; the total is 9,960 h.p. On second section, the total trains are twelve, with a total of 4,320 h.p., and on third section 2,240 h.p., giving a total for twenty-five miles section of 16,720 h.p. Multiplied by four, this gives 66,880 h.p., and, taking the motors with gearing of the efficiency of 84 per cent., the figure of 71,620 h.p. = 59,396 kilowatts is arrived at, or, including main line, 64,000 kilowatts.

The first method of electrification selected is that of using direct current at 600 volts on the motors.

DIRECT-CURRENT SYSTEM.

Having found the power required by each section of the line, it remains to be decided how the substations shall be placed. There are two power stations. By using a three-wire system, *i.e.*, using the up third rail as 600 volts $\checkmark$ + the down third rail as 600 volts—power can be transmitted from the substations at 1,200 volts, instead of 600, thus saving much money in cables. Take the motors with gearing at an efficiency of 84 per cent.; the direct-current distribution at an efficiency of 90 per cent.; the rotary converters, at an efficiency of 90 per cent.; and 10 per cent. for ohmic loss in rails leakage, switchboard and controlling apparatus, 90 per cent.; the transformers at 94 per cent. This gives an overall efficiency from the train wheels to the l.t. side of the transformers of 61.2 per cent., and an efficiency of 57.5 per cent. from the train wheels to the h.t. side of the transformers.

The following is a short description of substations in Section No. 1: The substation contains six rotary converters, two of 1,500 kilowatts and four of 1,000 kilowatts. The rotaries are to be capable of standing a 25 per cent. overload continuously. Each rotary to have its own set of three transformers connected up in mesh (Δ).

There are two booster sets, each set consisting of three machines, as follows:—

First set. One induction motor, driving two series boosters, each of 50 kilowatts (33 volts at 1,530 amperes), one on each end of the induction motor.

Second set. One induction motor, driving two series boosters, each of 25 kilowatts (16.5 volts at 1,530 amperes) one on each end of the induction motor.

The two high tension three-core cables are brought through oil break switches to the high tension bus bars, and from the high tension bus bars through oil break switches to the high tension side of the transformers; the low tension side of the transformers being brought through

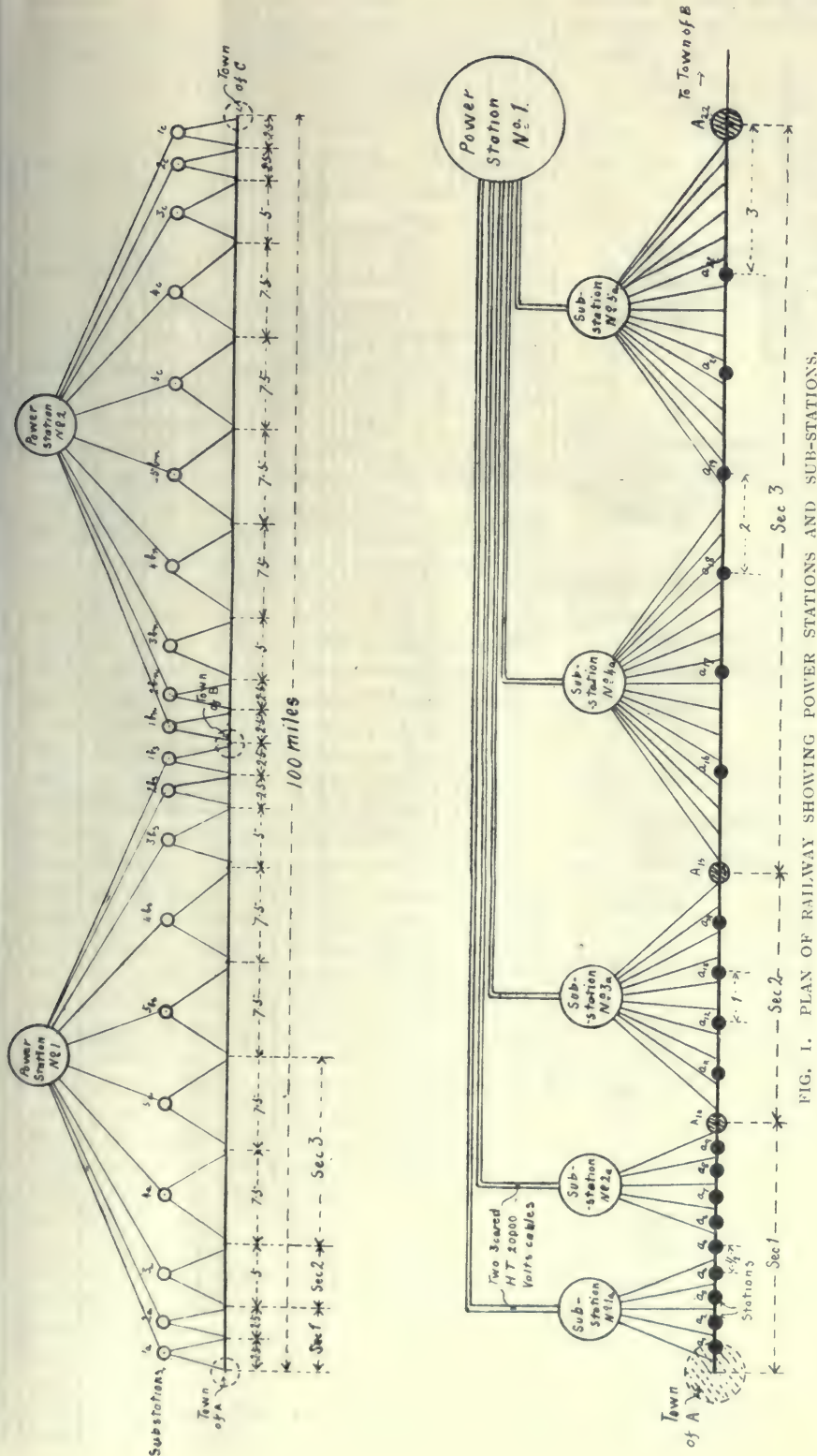


FIG. 1. PLAN OF RAILWAY SHOWING POWER STATIONS AND SUB-STATIONS.

ordinary three-pole knife switches to the low tension bus bars.

The rotaries are started up from induction motors on the ends of the rotary shaft, the induction motors being connected through three-pole knife switches to the low tension bus bars.

On the direct-current side, the [rotaries] are connected to double-pole throw-over knife switches, so as to be able to put the machine on to the up or down line. The booster sets are connected up to booster bars, the induction motor being driven off the low-tension bus bars. The feeder cables are connected to single pole throw-over knife switches, so as to be able to connect them on to the booster bar or directly on to the bus bar.

The middle bus bar is connected to the rails through a large knife switch; this switch and cable only has to carry the out-of-balance current; possibly it might be advisable to use a balancer set, but this the author does not consider necessary.

For the sake of clearness, no instruments have been shown in the wiring diagram. (Fig. 2.)

It is proposed to transmit the power three-phase 20,000 volts, using two three-cored cables, each cable being capable of taking the full load, and allowing a 4 per cent. loss (i.e., 8 per cent. each when carrying

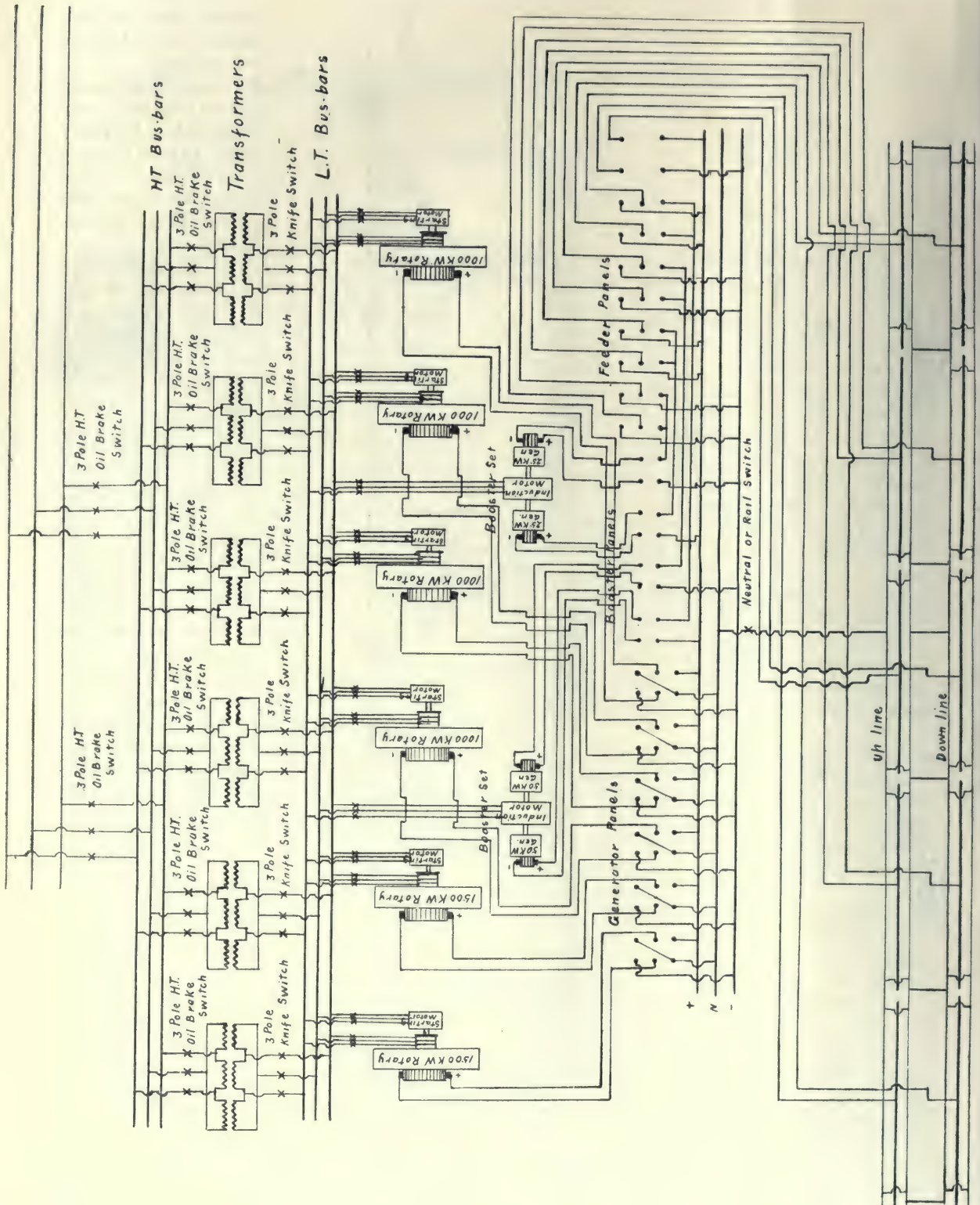


FIG. 2. WIRING DIAGRAM OF SUB-STATION I, 2, 2a, ETC.

full load). On these lines, the author calculates the capacity of the power stations, thus:—

4	sub-stations of 6,600 kilowatts=	26,400 kilowatts.
2	„	5,920 „ 11,840 „
4	„	2,070 „ 8,280 „

Total=46,520 kilowatts.

* * The capacity of the power station = $\frac{46,520 \text{ by } 100}{96} = 48,500$ kilowatts, say, 50,000 kilowatts.

SINGLE-PHASE METHOD.

For the sake of comparison, the author assumes a use of 600 volts on the third rail, and the same power stations, although this shows the single-phase scheme at a disadvantage.

Transmitting at 20,000 volts three-phase to transformers placed along the line half a mile apart, using two transformers connected up Scott's method of transforming from three-phase to two-phase, and using a two-phase distribution on the third rails, *i.e.*, using the up third rail as one phase, the down third rail as the other phase, and the rails as a common return. It is to be noted that the rails, instead of carrying the out-of-balance current as in the direct-current method, are now carrying $\sqrt{2} = 1.414$ times the current in one phase (assuming balanced circuits), and the voltage between the up third rail and the down third rail will be $\sqrt{2} \times 600 = 848$, instead of 1,200 as before.

The rails will have to be well bonded and cross-bonded. Taking the motors with gearing at an efficiency of 80 per cent. (a lower efficiency than the direct-current motor is allowed because of the greater iron loss); transformers at an efficiency of 94 per cent. and 15 per cent. for ohmic losses in rails leakage; switch-board and controlling apparatus, 85 per cent. (A greater loss is allowed because of the heavier current in the rails and loss due to using alternating current in the iron.)

This gives an overall efficiency of 64 per cent. from the h.t. side of the transformer to the train wheels, *i.e.*, 6.5 per cent. above the direct-current method.

The capacity of the sub-stations or transformer-houses in this case will be calculated as follows: In first section, there are twenty-four trains on a five-mile section, at one time, *i.e.*, probable maximum number of trains on a half-mile section at one time is three + one main line train. The average h.p. of a train in this section is 415.

* * Total h.p.=3 by 415 + 640 (for main line train)=1,885.

In second section, there are twelve trains on a five-mile section at one time, *i.e.*, the probable maximum

number of trains on a half-mile section is two + one main-line train. The average h.p. of a train in this section is 360.

* * Total h.p.=2 by 360 + 640=1,360.

In third section, there are eight on a fifteen-mile section at one time, *i.e.*, the probable maximum number of trains on a half-mile section at one time is one + one main-line train. The average h.p. of a train in this section is 305.

* * Total h.p.=305 + 640=945.

The capacity of the power houses in this case can be calculated from the efficiencies, thus:—

Total h.p. required at the train wheels for the 100 miles=66,880 h.p. for local trains by 5,120 h.p. for main-line trains=72,000 h.p.—53,750 kilowatts and the overall efficiency=61.3 (motors at 80 per cent., transformers at 94 per cent., ohmic losses in rails, etc., 85 per cent., and h.t. transmission 96 per cent.). Note the overall efficiency of the direct-current method was 55 per cent.

* * Capacity of power house = $\frac{53,750 \text{ by } 100}{2 \text{ by } 61.3} = 43,900$ kilowatts, say, 45,000 kilowatts, *i.e.*, 5,000 kilowatts less than the direct-current method, and 10,000 kilowatts on the 100 miles line.

The author then deals with the Westinghouse single-phase railway motors, and the Latour single-phase motor.

A good discussion on the merits and demerits of single-phase motors of various types, both induction and repulsion, followed the reading of the paper. It was agreed that the single-phase system was preferable, as it showed the higher efficiency.

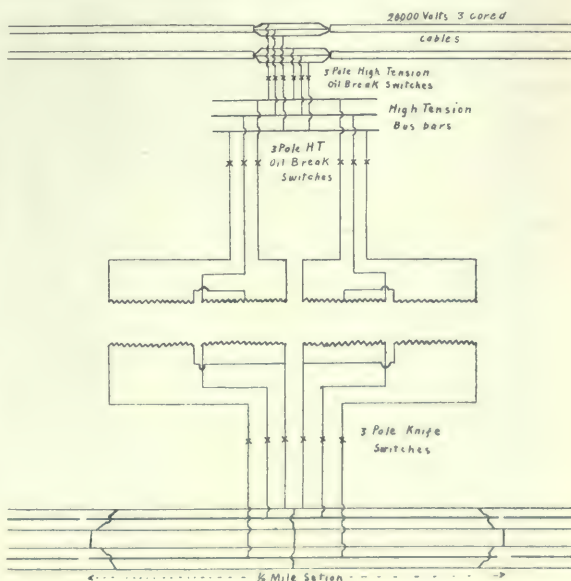


FIG. 3. WIRING DIAGRAM OF TRANSFORMER SUB-STATION.



Meeting of the Iron and Steel Institute at New York.



(Continued from page 598.)

IRON AND STEEL AT THE ST. LOUIS EXHIBITION.

By PROF. H. BAUERMAN.

THIS paper proved to be an able review of the Exposition from the point of view of the Iron and Steel Institute. The following excerpt deals with the British section:—

The principal feature in the British section is the collection of specimens illustrative of the mining industry of the United Kingdom, exhibited by the Home Office. This was made by Mr. Ware and Mr. Williams, of the Mining Department of the Home Office. It contains contributions from two hundred different firms and companies, each contributor being restricted, as far as possible, to a single specimen. The arrangement is the alphabetical one adopted for statistical purposes by the late Sir Clement Le Neve Foster. It is further illustrated by a numerous series of photographs of mine-working, both open air and underground. These are mostly by Mr. Williams, with a smaller number by Mr. J. C. Burrows. Mr. H. W. Hughes's well-known photographs of South Staffordshire mines form an independent contribution.

The Geological Survey, through the Education Department, send a large series illustrative of the recent progress of the Survey, the prominent items being the new map of the North Staffordshire coal-field on the 6-in. scale, and the 1-in. map of the Western Highlands of Scotland, the latter being accompanied by a model of the Assynt district on a large scale. A new

model of the Purbeck district embodies the work of Mr. Strahan and others in the revision of the earlier survey, and the 6-in. scale model of London, which has been on view in the Jermyn-street Museum for the past thirty years has also been sent. The Geological Survey of India is represented by a selection of its latest works and publications.

The metallurgical exhibits include two small but effective cases, contributed by the Monk-bridge and Farnley Iron Collieries, illustrating Best Yorkshire iron, while Shropshire and Derbyshire are represented by the Lilleshall and Sheepbridge companies respectively. The microphotographs prepared by the late Sir William Roberts-Austen in illustration of the reports made to the Alloys Research Committee of the Institute of Mechanical Engineers, form part of the Board of Education exhibit; but the large and important series of the same kind by Messrs. Stead, Harbord and Campion, and the Great Eastern Railway Company are included in the general exhibition of British scientific photography in the Liberal Arts Building.

The Board of Agriculture in Ireland contributes a very fine series of Irish economic minerals, mainly building-stones and marble. There are two other British marble exhibits, both representing the re-discovery of ancient quarries, one being the dark fossiliferous marble of Durham, sent by the Harehope Mining Company, and the other the famous Verde Antico marble of Thessaly.

(To be continued.)

NEW PATENT CLINKER CRUSHER AND GRADER BY THE HORSFALL DESTROYER COMPANY, Ltd.

AN important use for clinker from destructor plants is in the formation of filter beds for sewage works, for which purpose it is found to be superior to coke.

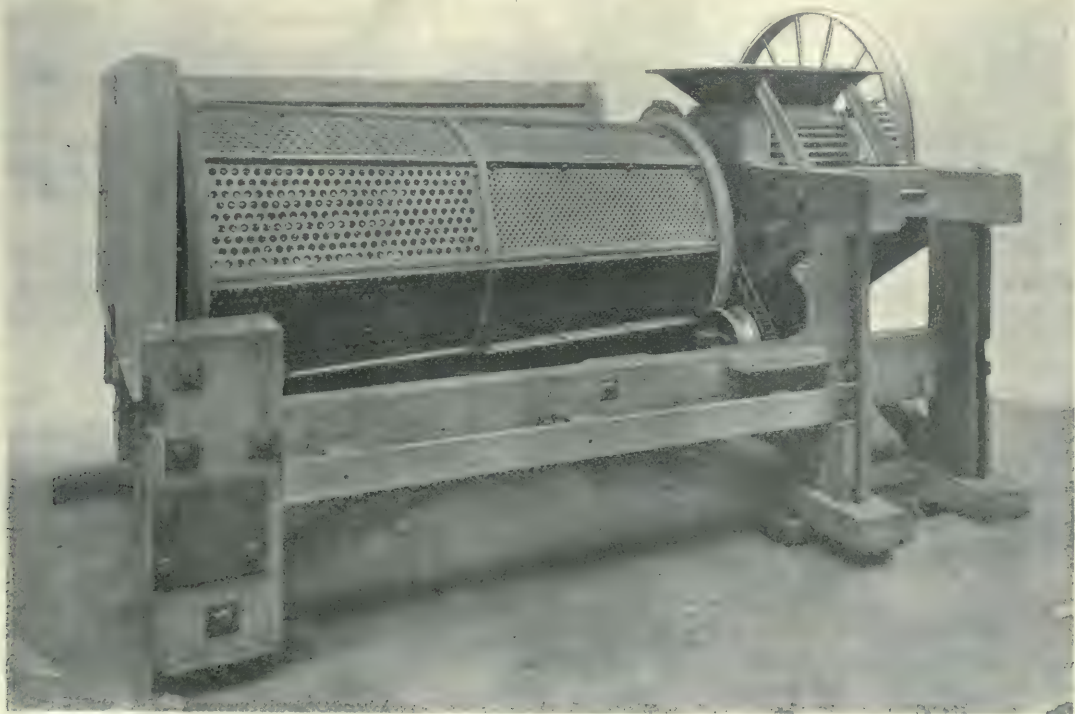
For crushing and grading the clinker to suitable sizes for this purpose, and for making concrete etc., the Horsfall Destructor Company, Ltd., of Leeds, have erected some special machines based on the patents of Mr. J. H. Cox, M.Inst.C.E., the city surveyor of Bradford, and his colleague the late Mr. J. McTaggart.

The machine illustrated herewith is one of the self-contained type. The clinker is thrown into a hopper *a* (page 708), from which it passes through a pair of fluted crushing rolls *b*, which have renewable chilled faces. The rolls are set to a suitable distance apart for the material to be used. The crushed material passes through

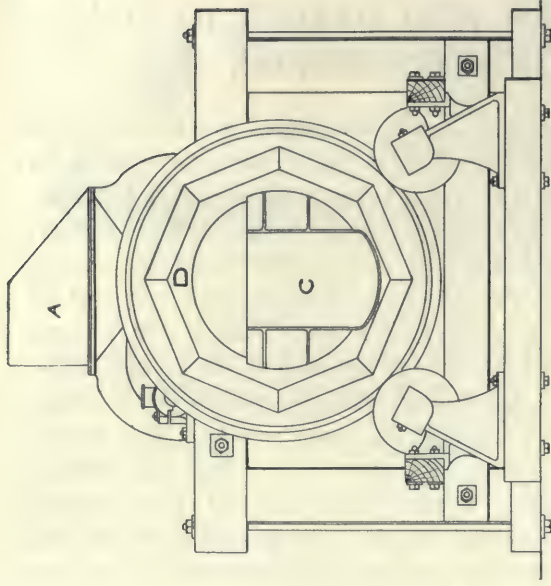
the shoot *c* into the screen *d*. The screen is octagonal in form, which greatly increases its efficiency owing to the beating motion imparted to the material. It gives three sizes of clinker, the finest from the smallest half, the middle size from the larger half, and the largest of all delivered over the end. The screen has no inner shaft, but is carried on friction rolls, and the friction rolls nearest to the crushing end are driven by chain gearing. This affords a neat and efficient method of driving the screen.

The gearing throughout is exceptionally strong and massive, and has been so designed that when unbreakable materials, such as large pieces of wrought iron occasionally are permitted to enter the machine, the belt will slip before anything will break.

The machine, when necessary, can be arranged with the crushing rolls below ground.



SELF-CONTAINED MACHINE, CRUSHING AND GRADING FOUR TONS OF CLINKER PER HOUR.

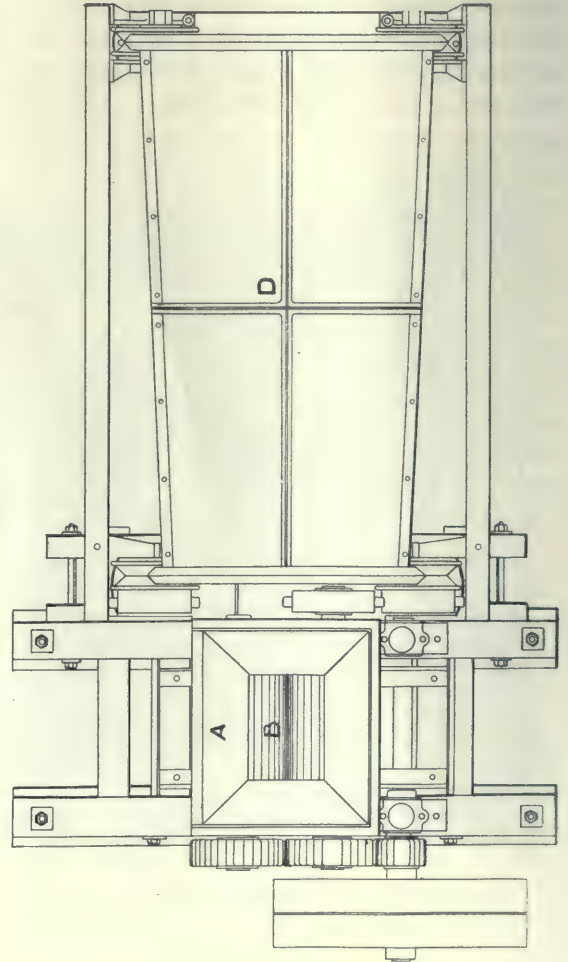
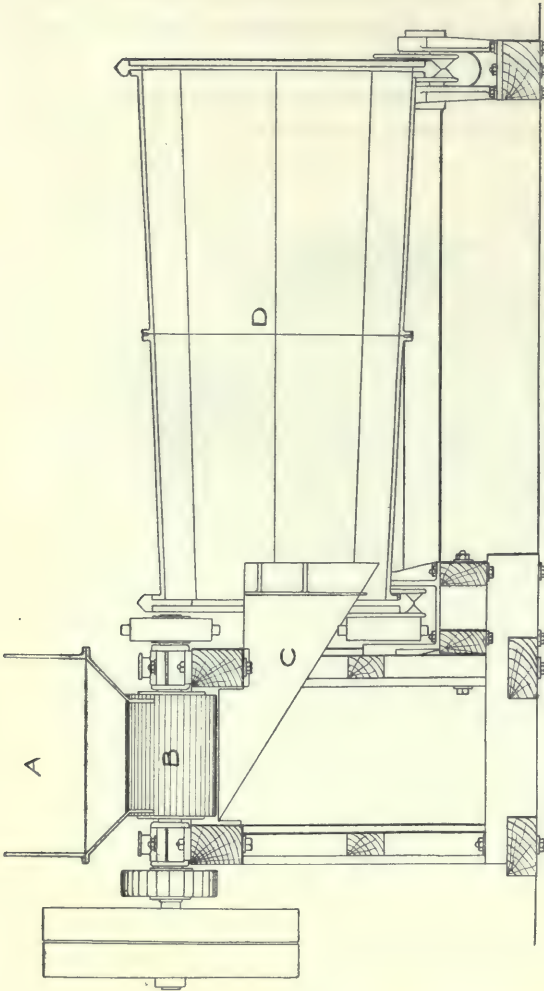


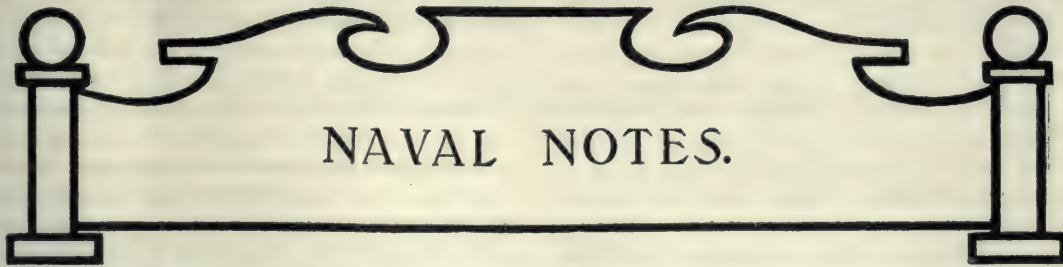
PLANS AND SECTIONAL ELEVATION OF NEW PATENT
CLINKER CRUSHER AND GRADER, BY THE HORSFALL
DESTRUCTOR COMPANY, LTD.

From the hopper A the clinker passes through the fluted crushing rolls B, which are set a suitable distance apart according to the nature of the material.

From the shoot C the crushed material passes to the octagonal screen D, which is carried on friction rolls.

This machine crushes and grades about four tons of material per hour.





NAVAL NOTES.

WEEKLY NOTES ON NAVAL PROGRESS IN CONSTRUCTION AND ARMAMENT.

(BY OUR NAVAL CORRESPONDENT.)



THE full significance of the nominations for high commands which it was announced last week had been approved by the King, is not yet grasped in many quarters. To the man in the street the only naval officer of the day is Lord Charles Beresford. He learns that he is appointed to succeed Sir Compton Domville in command of the Mediterranean Fleet, and, probably, remarks, "Oh! of course. Our most important Fleet! Beresford's just the right man for the place." But to the student, to the man who has given some little study to the why and wherefore of things naval, it is the retention of Sir Arthur Wilson in command of the Home Fleet that is most significant.

Those with a knowledge of naval history will remember that there was a time when the fleet in the English Channel was the most important factor in the strategical disposition of the British Fleets and squadrons. It was always commanded by the senior flag officer, flying his flag afloat. In a word, the British Admiralty kept their strongest fighting force in the centre of the naval activity of the period. Then came a time when the needs of the naval situation brought about a change in the disposition of the fleets. The tide of naval strength had ebbed to the south, the Mediterranean command became the most important in the gift of the Admiralty. From that day to this, the command of the Fleet in the Mediterranean has remained the highest dignity afloat, the culminating point in a naval officer's career at sea. Sir Compton Domville is to-day as much senior to Sir Arthur Wilson, as Sir Arthur Wilson is senior to Lord Charles Beresford. But what is to happen next spring when these new appointments take effect? Sir Compton Domville is succeeded by Lord Charles Beresford, and Sir Arthur Wilson remains in command of the Home Fleet. In other words, the command of the Fleet in home waters is to-day considered of more importance than the command of the Fleet in the

Mediterranean. The centre of naval activity has once more shifted.

There have been for a long time past indications that in the eyes of the Board of Admiralty the Home Fleet was assuming far greater importance than had previously been accorded it. The addition to its ranks of the new battleships *Triumph* and *Swiftsure* was a startling innovation. The recall of the *Exmouth* and *Russell*, after their first commission in the Mediterranean, and their subsequent addition to Sir Arthur Wilson's command, were further signs, and the recent announcement that at the earliest possible moment the remaining four vessels of the *Duncan* class will be brought back to join the Home Fleet, only requires a little consideration to show that when that has been done, the Home Fleet will be composed entirely of modern vessels. Already, the *Anson*, *Benbow*, *Hood*, and *Sans Pareil* have been removed, and it only remains to replace the *Empress of India*, *Revenge*, *Royal Oak*, and *Royal Sovereign* by newer vessels, to make of the Home Fleet a fighting force equal to any demands which the defence of the naval interests of this country may make.

I have not hitherto dealt at any length with the question of transference of the balance of naval power from the Mediterranean to the Baltic, which has been so agitating the minds of the naval correspondents of most newspapers. But this speedy recognition by the Board of Admiralty of the growing importance of maintaining in the North Sea a force capable of checking the hostile aims which may, at any time, burst upon us, is a comforting and satisfactory aspect of the situation. With France we are most friendly. Neither Italy, Austria-Hungary, nor Spain, entertains anything but respect and amity for the British nation. It is nearer home that the menace to peace lies. It is no part of the policy of this paper to bring forward accusations of breaches of neutrality, or secret understandings. But those who read their papers diligently during the recent crisis must have

noted many signs that if war had come, Russia might not have fought unaided.

Not only in the commands and compositions of our principal fleets are great changes being carried out, but also in the training squadrons. The efficacy of sail drill as a preparation for life in a modern warship has long been questioned, and now the Board of Admiralty has inculcated changes which will result in making the training squadron an efficient and homogeneous fighting force. The *Northampton*, for some years past in commission as sea-going training ship for boys has been relieved by the *Hawke*, and the *St. George* will take over the duties recently performed by the *Calliope* and *Cleopatra*. The *Gibraltar* again will be commissioned to replace the *Medea*, *Medusa*, and *Isis*, all old vessels, and the *Royal Arthur*, latterly flagship on the Australian station, will be allocated to the training of navigating officers in place of the *Mercury*. In addition, to these changes, the *Aurora*, tender to the *Britannia*, turned over to the *Highflyer* last Saturday, and for the future this vessel with the *Isis*, which is of about the same date, will be employed as the sea-going tenders to the *Britannia*, at Dartmouth.

There are a number of other changes being carried into effect. The *Immortalite*, tender the *Wildfire*, gunnery school at Sheerness, is to be relieved by the *Endymion*, the crew of the latter vessel turning over to the *Cumberland*, which will hoist the pennant for the first time on December 1st. The Devenport gunnery school ship *Cambridge* is also to receive a new sea-going tender, the *Theseus* replacing the *Undaunted*, while at Portsmouth the *Grafton*, which is returning to England about the second week in January, will relieve the *Narcissus* as tender to the *Excellent*. The *Endymion*, *Theseus*, and *Grafton* will be fitted with various types of guns for training purposes, in the same way as the vessels they are replacing have been fitted. The present crew of the *Theseus* will turn over to the *Cornwall*, which, it will be remembered, is with the *Cumberland*, to form part of the augmented Cruiser Squadron.

In addition, large numbers of small craft on service on foreign stations are being brought home and paid off. For many years, to meet the requirements of the Indian and Colonial offices, small vessels have been kept on stations where navally, speaking, they were of little value, and their withdrawal from service will effect a considerable saving without in any way impairing the war readiness of the Fleet.

These changes are of great significance. They show that the training and education of officers and men, which was so radically reformed by the new scheme published in 1902, is not to be allowed to fall behind

the times, and that as the researches of naval constructors and manufacturers of armament and ammunition lead to the improvement of the material of the Fleet, the personnel shall be trained to keep pace with the changes in the weapons they are to control and work.

In the final report of the Boiler Committee, it will be remembered, Sir Compton Domville took occasion to say that the improvement in the Belleville boiler, and the results obtained from that steam generator in vessels under his command in the Mediterranean Fleet, had led him to modify in some degree his original opinion of the utility of the Belleville, which was frankly hostile. The Belleville has been very much misunderstood and misused in the past, and the capabilities of this type of boiler are only now beginning to be appreciated in this country. Engineer Commander A. W. Turner, who was the first British naval engineer officer to have experience with the Belleville fitted in a man-of-war, has rendered a great service to the Fleet by the excellent results he has obtained from the *Terrible* in her recent passage to Wei-hai-Wei and back. The *Terrible*, it will be remembered, came back from China in 1902, under command of Captain Percy Scott, for refit, and this year, having been thoroughly overhauled, she made the voyage to Wei-hai-Wei and back under Captain A. T. Stuart, with Engineer Commander Turner in charge of the engine-room.

The results of the two voyages are given in tabulated form for convenience of reference.

	1902.	1904.
Total distance run	knots 11,045	21,741
Draught of water	mean 26 ft. 7 in.	27 ft. 3 in.
Mean speed	knots 11·8	12·6
Total consumption of coal	tons 11,163	10,092
Distance run per ton (main engines only)	knots 1·55	3·37
Coal consumption per i.h.p. per hour (main engines only)	lbs. 2·9	1·78

The above figures scarcely need comment, but it must be pointed out that whereas in 1902, 11,163 tons of coal were burnt on a voyage of 11,045 knots, this year only 10,092 tons were burnt on a voyage of 21,741 knots, that is to say, that, whereas in 1902 each ton of coal consumed by the main engines only served to carry the vessel 1·55 knots, this year for the same consumption the vessel was made to travel 3·37 knots. And it must be borne in mind that this voyage was not made under the ægis of the Boiler Committee. It was an ordinary trial under ordinary conditions of service, and as such is a remarkable testimony to the possibilities of the Belleville boiler when in the hands of a capable and experienced engine-room staff.

There has been but little news of moment from foreign naval circles during the week, and consideration of progress in other navies must, therefore, be left for next week.

THE WEEK AMONG THE TECHNICAL SOCIETIES.

THE INSTITUTION OF MECHANICAL ENGINEERS.

IMPACT TESTS ON THE WROUGHT STEELS OF COMMERCE.

The monthly meeting of this Institution was held at Storey's-gate, St. James'-park, on Friday last, when a paper on this subject was submitted. The authors of the paper were Mr. A. E. Seaton and Mr. A. Jude. The following is an abstract:—

The objects of the paper are to show some of the characteristics and peculiarities of the wrought steel as supplied by steel manufacturers for commercial purposes. Considerable movement has been made of late towards the establishment of a shock test for steel, conducted on a smaller scale than is the custom with axles, for instance where the full-sized article is tested. The authors are strongly of opinion that progress in this direction is taking place still too slowly, and it is therefore the aggregate object of this paper to help towards a further appreciation of this valuable test. All the experiments have been made on the ordinary steel as supplied by various manufacturers as suitable for such parts.

The tensile tests have been made on a Buckton-testing machine, while the shock tests have been carried out in an apparatus, specially designed by the authors. Such apparatus, as shown in fig. 1, consists essentially of a weight of 6 lb., arranged to drop freely through 24 in. on to the test bar, figs. 2 and 3, which rests on fixed supports 3 in. apart. The test bar is

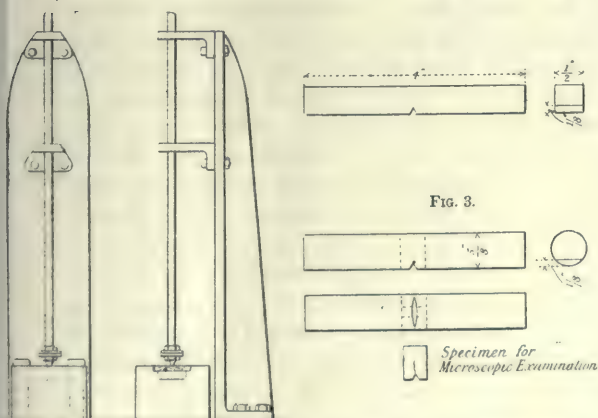


FIG. 1. "IMPACT" TESTING MACHINE AND "IMPACT" TEST BARS.

4 in. long, so that there is $\frac{1}{2}$ in. overlap at each end. After each blow the test piece is reversed.

THE IMPORTANCE OF SHOCK TESTS.

There are many tests to which a piece of steel may be subjected, tension, and elongation, compression, cross-bending, fatigue, impact on notched and un-notched bars, and many others, and the question may be fairly asked which of these tests is really a true universal gauge of the suitability of a piece of steel for any purpose it may be put to. In the case of a steam engine, 87.6 per cent. of the whole engine is subject to more or less shock, while pure tension forms an insignificant percentage of the total stress. Many machines are working under similar conditions. The failure of steel is often by shock and not by true alternating or variable stresses. As a comprehensive test for steel forgings the authors favour impact on a notched bar. Such test appears to be a good gauge of the preponderant stress, it is a test of ductility, and, moreover, about 97 per cent. of all forgings are notched in some way or other.

It is pointed out, however, that there may be obtained an excellent tension and elongation result from steel which is quite incapable of resisting shock. To make tension tests and trust more or less to them alone is a mistake. Further, while the elastic limit in given grades varies between comparatively insignificant limits, the shock strength can vary almost between infinite limits.

MEANS OF MAKING IMPACT TEST.

Opinions vary on this point, but on the whole the consensus of opinion appears to be that it should be made with a machine that breaks at one blow, and at the same time measures the energy expended.

Although there is no relation between the tensile-stress test and the alternating-stress test, or between the tensile test and the shock test, the authors are not prepared to say that there is no relation between the alternating-stress test and the shock test. They will, indeed, be glad to learn that there is a close relation, since then the controversial ground as to the nature of the forces, "alternating" or "shock," is at once eliminated. They think it possible that a relation does exist, because, although there are differences in the disturbance of the metal in the vicinity of the fracture, the radical phenomena ("dislocation" and "cleavage") are the same.

Description.	Normal Condition.				Analysis. Average per cent.	Oil-Quenched.			General Remarks.
	Impact. No. of blows.	Maximum stress. Tons per sq. in.	Elongation per cent. on 2 inches.	Condition.		Impact. No. of blows.	Maximum stress Tons per sq. in.	Elongation per cent. on 2 inches.	
Low carbon steel. Acid.	7	—	—	—	$\left\{ \begin{array}{l} \text{C. 0.15 to 0.15} \\ \text{S. 0.032 to 0.056} \\ \text{P. 0.033 to 0.023} \\ \text{Mn. 0.63 to 0.75} \\ \text{Si. 0.065 to 0.057} \end{array} \right\}$	165	—	—	$\left\{ \begin{array}{l} \text{Original bars 2 inches diameter.} \\ \text{Oil-quenched in test-bar form.} \\ \text{Impact test-bars } \frac{5}{8} \text{ inch diameter.} \end{array} \right\}$
	5	26.9	29.8	as received		159	25.7	31	
	165	—	—	—		177	—	—	
	163	—	—	—		181	—	—	
Low carbon steel. Basic.	293	23.2	46	—	$\left\{ \begin{array}{l} \text{C. 0.17, S. 0.051} \\ \text{Mn. 0.45, P. 0.044} \\ \text{C. 0.017, S. 0.050} \\ \text{Mn. 0.065, P. 0.052} \\ \text{C. 0.073, S. 0.056} \\ \text{Mn. 0.6, P. 0.053} \end{array} \right\}$	301	27.8	35	$\left\{ \begin{array}{l} \text{Original bars } \frac{3}{4} \text{ inch diameter.} \\ \text{Oil-quenched in test-bar form.} \\ \text{Impact test-bars } \frac{5}{8} \text{ inch diameter.} \end{array} \right\}$
	217	26.3	40.5	as received		280	31.5	38	
	1	55.7	12	—		5	74.4	3	
	23	32.5	35	as received		105	37.8	31.4	
Medium carbon steel. Admiralty.	35	—	—	$\left\{ \begin{array}{l} \text{annealed} \\ \text{in lime} \end{array} \right\}$	$\left\{ \begin{array}{l} \text{C. 0.23} \\ \text{S. 0.036} \\ \text{P. 0.058} \\ \text{Mn. 0.76} \\ \text{Si. 0.05} \end{array} \right\}$	—	—	—	$\left\{ \begin{array}{l} \text{Original bars 2 inches diameter.} \\ \text{Oil-quenched in test-bar form.} \\ \text{Impact test-bars } \frac{1}{2} \text{ inch square.} \end{array} \right\}$
	35	—	—	$\left\{ \begin{array}{l} \text{annealed in} \\ \text{coke dust} \end{array} \right\}$		—	—	—	
	5	—	—	as received		111	—	—	
	47	—	—	$\left\{ \begin{array}{l} \text{annealed} \\ \text{in lime} \end{array} \right\}$		—	—	—	
Ordinary grade.	5	—	—	$\left\{ \begin{array}{l} \text{annealed in} \\ \text{coke dust} \end{array} \right\}$	$\left\{ \begin{array}{l} \text{P. 0.058} \\ \text{Mn. 0.76} \\ \text{Si. 0.05} \end{array} \right\}$	—	—	—	$\left\{ \begin{array}{l} \text{(a) } \frac{5}{8} \text{ inch square test-bars cut from core of} \\ \text{3-inch bar previously oil-quenched. Micro-} \\ \text{structural appearance same in core as in outer} \\ \text{zone, showing that toughening extends to the} \\ \text{core. (b) (c) Similar bars cut from the outer} \\ \text{zone.} \\ \text{Test-bars from } 2\frac{3}{4} \text{ inch oil-hardened bolts as} \\ \text{received from makers.} \\ \text{Impact test-bars } \frac{5}{8} \text{ inch diameter.} \\ \text{Test-bars cut from } \frac{3}{8} \text{ inch to } 1\frac{1}{4} \text{ inch bars.} \\ \text{Impact test-bars } \frac{5}{8} \text{ inch diameter.} \\ \frac{5}{8} \text{ inch diameter bar.} \end{array} \right\}$
	—	—	—	—		(a) 73	—	—	
	—	—	—	—		(b) 73	—	—	
	—	—	—	—		(c) 95	—	—	
Bright rolled bar.	3	—	—	—	$\left\{ \begin{array}{l} \text{C. 0.11 to 0.15} \\ \text{—} \\ \text{—} \\ \text{—} \\ \text{—} \end{array} \right\}$	107	32.5	34.5	$\left\{ \begin{array}{l} \text{Test-bars from } 2\frac{3}{4} \text{ inch oil-hardened bolts as} \\ \text{received from makers.} \\ \text{Impact test-bars } \frac{5}{8} \text{ inch diameter.} \\ \text{Test-bars cut from } \frac{3}{8} \text{ inch to } 1\frac{1}{4} \text{ inch bars.} \\ \text{Impact test-bars } \frac{5}{8} \text{ inch diameter.} \\ \frac{5}{8} \text{ inch diameter bar.} \end{array} \right\}$
	3	35.4	25.2	—		109	—	—	
	1	—	—	—		19	29.1	39	
	3	—	—	—		21	—	—	
	183	31.9	24.5	—		25	—	—	

TABLE GIVING RESULT OF A NUMBER OF PAIRS OF TESTS OF NORMAL AND OIL-QUENCHED STEELS.

The authors refer to the grave risk of breakage with high-speed modern machines, and point out that the comparative immunity from failure is due to the large margin allowed for safety. If the desire to keep scantlings down to a minimum is realised, then security will only be obtained by ensuring that the steel used shall have the maximum shock strength of its grade. The authors urge the engineer to demand of the steel maker that he should supply the ordinary grades of steel with a more uniform "shock" quality.

TREATED STEEL.

In the foregoing the subject matter has been strictly confined to the strength, etc., of steel in its natural condition, or that condition produced by the comparatively slow cooling process of ordinary manufacture. The shock strength of "treated" steels, however, is a matter of equal, if not greater importance. "Treated" means any process whereby the steel is left in a more or less artificial condition as distinguished from the

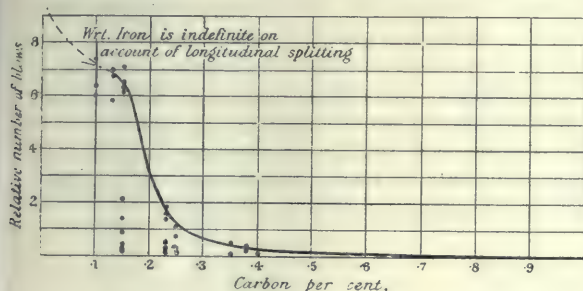


FIG. 2. CURVE MAXIMUM SHOCK STRENGTH OF COMMERCIAL "PEARLITIC" STEELS. (FORGED OR ROLLED QUALITY.)

natural condition just discussed; such as oil-hardening, water hardening, tempering and allied processes. The authors have not had the time nor facilities for conducting a complete series of experiments with these steels, but they have done quite sufficient to be assured of the fact that the shock strength of oil-quenched mild steels particularly is not increased a mere matter of 20 per cent. (720 deg. C. in oil, 0.25 C.) to 130 per cent. (1,200 deg. C. in water), as is the case with the tensile strength, but on an average 500 to 600 per cent. more than the shock strength of the natural steel in its best condition. Moreover, oil-quenching appears to possess the highly important property of "levelling up" the shock strength of steel to a fairly constant value.

The table on previous page gives the results of a number of pairs of tests of normal and oil-quenched steels.

INSTITUTION OF ELECTRICAL ENGINEERS.

MAGNETIC FLUX DISTRIBUTION IN TOOTH-CORE ARMATURES.



An ordinary general meeting was held yesterday, when a paper on "Hydrodynamical and Electromagnetic investigations regarding the magnetic distribution in toothed-core Armatures" was sub-

mitted. The authors are Professor H. S. Hele-Shaw, F.R.S., Alfred Hay, D.Sc., and P. H. Powell, M.Sc. The following is an abstract of the paper:—

The experiments with which the paper deals occupied a period of two years, and attention is directed not only to the investigation of the authors, but to those of other workers on the same field, and the results are stated in a form which will render them available for immediate practical use.

The hydrodynamical method of attacking two dimensional magnetic problems was described four years ago by two of the authors of the present paper.

In trying to put the principle of this method into practice, the following difficulties have to be overcome: The difficulty of mapping out the invisible stream-lines of the fluid; the fact that there is no such thing as a 'perfect' fluid, every actual fluid being more or less viscous; the difficulty of finding an analogue for magnetic permeability, in order to study the flux distribution in cases where the field consists of regions having different permeabilities. The second difficulty at first proved almost insurmountable, but was finally overcome.

The results obtained by the hydrodynamical method were supplemented by experiments carried out on an actual dynamo, fitted with several armature cores, having different sizes of teeth, and slots and different air-gaps. It is in connection with the air-gap reluctance that the hydrodynamical method is of particular value.

AIR-GAP RELUCTANCE.

The paper, as stated above, is valuable because it not only records the results arrived at by the authors, but gives an account of the researches by others, notably Mr. F. W. Carter. The authors, after referring to the foregoing problem, and to Mr. Carter's mathematical solution of an ideal case, proceed to consider the flux distortion brought about by armature teeth. It is pointed out that the presence of teeth in the armature core is equivalent to an increase in the gap length. Assuming that the exact effect

produced by the teeth is known, a convenient method of applying the necessary correction consists in multiplying the gap length by a certain "correction coefficient." This "correction coefficient" clearly represents the ratio of the maximum to the mean induction. Mr. Carter arrived at a correction coefficient on the assumption of negligible pole-face curvature and infinite permeability in the teeth, and his results show satisfactory agreement with those arrived at by Prof. Hele Shaw's stream-line method. None of the older methods are reliable.

The problem of determining the reluctance of the teeth in a slotted armature has generally been dealt with on the assumption that the equipotential surfaces in the teeth and slots are cylindrical surfaces coaxial with the core discs. This assumption is far from being correct. Nevertheless, for practical purposes, the assumption yields sufficiently accurate results.

DISTRIBUTION OF MAGNETIC FLUX.

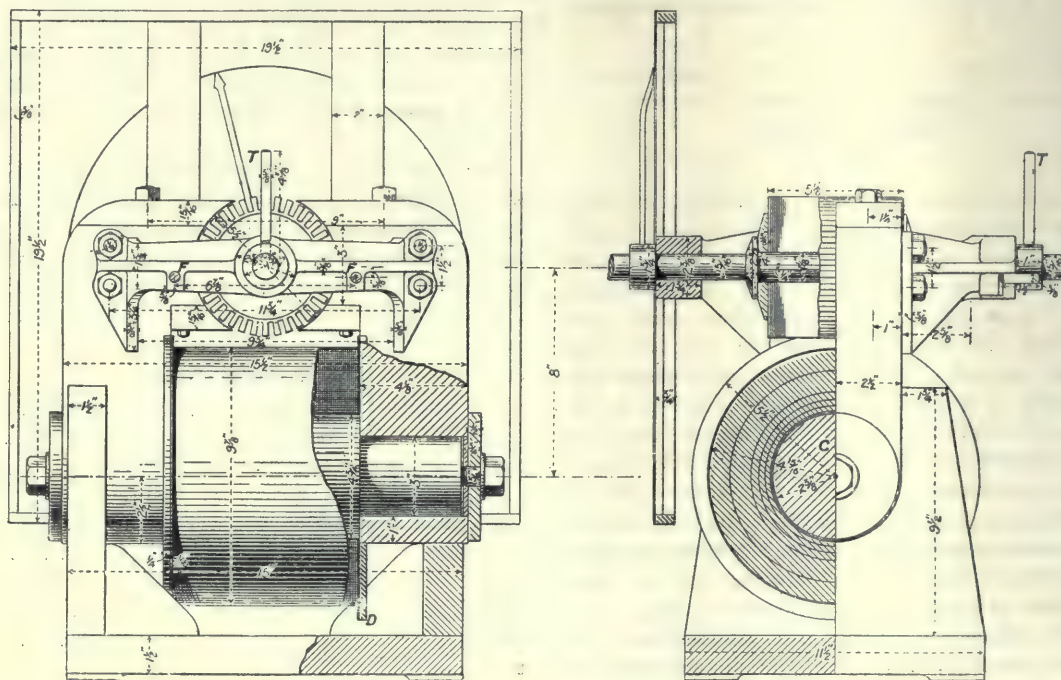
Experiments were made by the authors of this paper with the view to determining the exact distribution of the magnetic flux in the teeth and slots of a slotted core under varying conditions of excitation, and with varying length of gap and width of tooth.

The apparatus used was specially designed for the

purpose, and was constructed in the workshops of the University of Liverpool.

The dynamo (fig. 1) was of the single-bobbin type, with field core and pole-pieces of Allen's dynamo steel. The pole-pieces were bored out to a diameter of $5\frac{1}{2}$ in. and into the space between them could be introduced any one out of a set of five experimental armature cores. The cores consisted of sheet-iron stampings, threaded on the shaft, and maintained in position by means of a feather key. The details of the five cores are given in fig. 2 on page 715, which also shows the positions of the search-coils by means of which the flux at three different cross-sections of a tooth was determined. The three cross-sections corresponded to the top, the middle, and the bottom of a tooth. In addition to the three coils surrounding the tooth, a fourth coil, of width equal to that of a tooth and slot, was used for the purpose of determining the total flux per tooth and slot, and the mean value of the gap induction. This coil was slung in position by means of silk threads suitably supported from the armature shaft, and provided with a device for adjusting the coil in the exact position required (the middle of the air-gap). Each of the three coils surrounding the tooth consisted of five turns of No. 46 wire.

The moving coil ballistic galvanometer used in these experiments was of special construction; no suitable commercial instrument could be obtained.



RESULTS OF BALLISTIC EXPERIMENTS.

The magnetic flux through the top, the middle, and the bottom of the tooth was determined for five different values of the mean gap induction, ranging from about 3,000 to about 9,000 C.G.S. lines per square circumference, for each of the five armature cores experimented upon. The results obtained are shown in the table on page 716.

LIVERPOOL ENGINEERING SOCIETY.

ENGINEERING PROBLEMS IN GAS WORKS.

The second meeting of the thirty-first session was held on the 16th inst. Mr. Frank E. Priest, M.Inst.C.E., Chairman, presided, when Mr. E. Allen read a paper on the above subject.

The author pointed out that the systematic production of gas naturally involved the solution of many engineering problems. The chief problem in a gas

Preston was cited as a gas works with an ideal situation having a railway siding at a high level, canal at a low level, so that coal passed into the retorts by gravity and the coke was discharged into barges by the same inexpensive power. With regard to the actual process of manufacture, the new feature was the substitution of gaseous firing in place of the furnace, and it was still an open question whether the producer should form part of the setting. For the charging and withdrawing part of the work, the Arrol-Foulis and West's machine had been largely adopted. In the first, hydraulic power was employed, and in West's the motive power was compressed air. Later inventions were the Paris Turbine and the De Brouwer systems, in both of which electricity was the motive power employed, the former being in operation at the Beckton works of the Gas Light and Coke Company, and the latter at Derby, where it was said to have reduced the cost of carbonising to a very low figure. The De Brouwer plant was less expensive than the Turbine, and claimed to be more reliable.

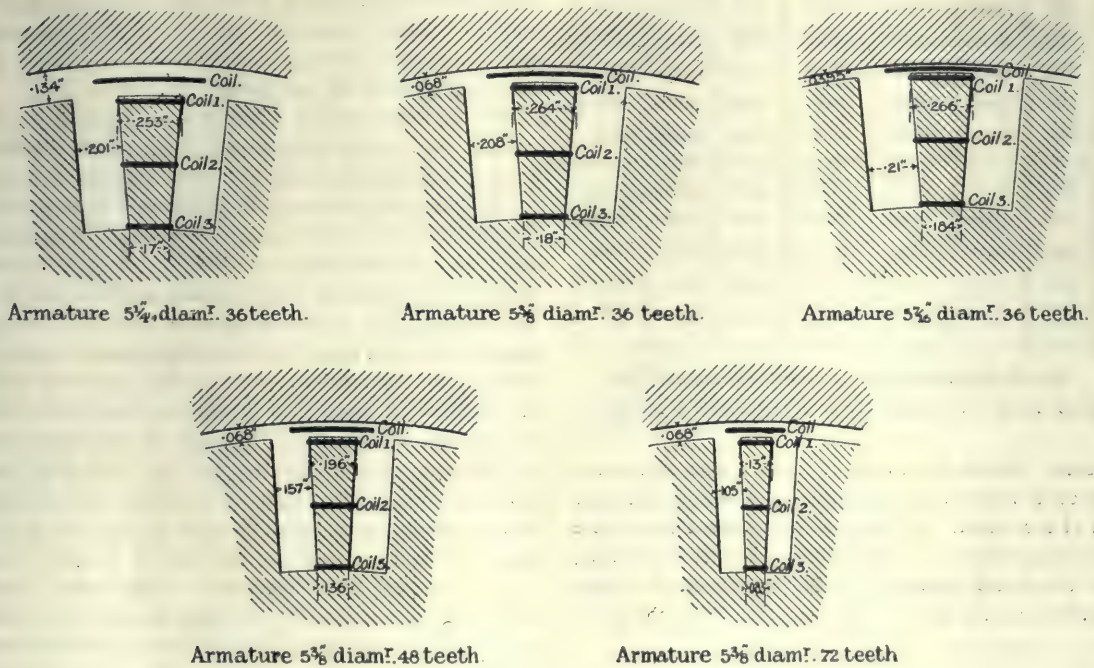


FIG 2. FIVE EXPERIMENTAL ARMATURE CORES.

works was how best to transform coal at one end into gas at the other. Various methods have been adopted for economically handling the coal in delivery. Simplicity of working and low cost of maintenance strongly recommended the hydraulic hoist for this work.

The problem of charging and discharging retorts had, said the author, been dealt with in an entirely different manner by the inclined retort system. With this method, too great importance cannot be attached to the sufficiency and uniformity of the heating of the

		TOTAL MAGNETIC FLUX.			MAGNETIC INDUCTION.		
	Mean Gap Induction	Top of tooth.	Middle of tooth.	Base of tooth.	Top of tooth.	Middle of tooth.	Base of tooth.
Armature 54" in diameter, 36 teeth.	2,860	37,000	44,400	43,800	4,790	7,040	8,570
	5,010	65,800	79,100	75,900	8,520	12,600	14,850
	6,650	81,900	102,500	97,400	10,600	16,300	19,060
	7,640	98,500	118,900	111,400	12,750	18,870	21,800
	8,110	103,200	125,000	112,300	13,370	19,850	21,980
Armature 58" in diameter, 36 teeth.	2,950	38,900	45,200	46,300	5,070	7,120	8,920
	5,540	71,200	84,600	86,000	9,280	13,400	16,600
	7,240	92,200	108,500	109,400	12,250	17,100	20,940
	8,550	107,800	126,400	121,800	14,060	19,900	23,500
	9,120	113,800	136,200	126,000	14,800	21,500	24,300
Armature 58" in diameter, 48 teeth.	3,290	33,200	39,100	39,600	5,350	7,440	8,700
	6,020	61,800	69,300	70,000	9,950	13,200	15,350
	7,860	79,500	89,500	87,600	12,800	17,000	19,200
	8,880	91,000	101,900	96,200	14,700	19,400	21,100
	9,440	97,500	105,400	101,000	15,700	20,000	22,140
Armature 58" in diameter, 72 teeth.	3,280	24,300	26,800	28,600	6,070	8,130	10,560
	5,810	40,300	44,900	46,000	10,080	13,600	17,000
	7,270	50,900	57,800	57,300	12,700	17,500	21,160
	8,380	58,400	66,200	62,300	14,600	20,100	23,000
	8,870	61,300	68,900	64,400	15,300	20,900	23,800
Armature 54 1/2" in diameter, 36 teeth.	2,680	36,100	43,400	43,500	4,280	6,020	7,450
	5,260	68,400	83,100	83,700	8,100	11,540	14,350
	7,030	100,700	122,000	122,700	11,900	16,950	21,000
	9,200	122,400	145,800	142,200	14,500	20,200	24,400
	10,000	133,300	154,100	150,200	15,800	21,400	25,700

TABLE SHOWING RESULTS OF EXPERIMENTS
DESCRIBED IN PROF. H. S. HELE-SHAW'S PAPER.

retorts. Unless the whole of the gas was driven off, the coke would stick together and would not flow out of the retort. At the present moment there were differences of opinion as to the best system to be adopted, and the matter was complicated by the varying local conditions. An interesting discussion followed

The Institute of Marine Engineers has had an interesting discussion on "Technical Education." Mr. Frank Cooper, Mr. W. E. Farenden, Mr. J. L. Precious, Mr. W. M. Laren, Mr. E. W. Ross, Mr. C. W. Barnes, and Mr. W. Lawrie were among the speakers at the last meeting. The debate stands adjourned until Monday next.

DUNDEE INSTITUTE OF ENGINEERS.

TIMBER: ITS STRENGTH AND HOW TO TEST IT.

A lecture was delivered on Thursday, November 17th, 1904, by Professor T. Hudson Beare, M.Inst.C.E.

The lecturer pointed out that though a very large number of experimental observations on the strength and other properties of timber were to be found in the older text-books, and in the proceedings of various technical societies, etc., many of these were unreliable. This unreliability was due mainly to the fact that in the older experiments no attempt was made to determine the moisture present in the timber at the time the test was carried out, and in very few cases was any data given as to the previous history of the timber. Again, most of the old experimenters used very small, picked specimens, and the results they obtained were, therefore, not really representative of the average quality of the particular kind of timber which was being tested. Ordinary well-seasoned timber in a dry building had a dryness of about 10 per cent. to 12 per cent. Bauschinger had shown in his researches that there was a definite numerical law connecting together the mechanical strength and the percentage of moisture present in any sample of timber.

The lecturer stated that the mechanical tests usually made upon timber were tensile, compression, cross bending, and shearing. He had carried out in the Fulton Laboratory at Edinburgh University, for the purpose of the lecture, a number of tension tests on different kinds of wood, in order to show how difficult it was to secure uniform results in tension experiments, and by use of lantern slides he showed how frequently a tensile bar would give way by shear rather than by tension. In both the American and in the German researches it was eventually decided to abandon tensile tests, because of this difficulty of securing uniform results, and on account of the fact that owing to the high tensile strength of timber as compared with its shear strength, it was considered that it would be unlikely for timber to give way by tension in any structure. Compression tests were much more readily carried out, and when the point which it was desired to elucidate was the average quality of the sample of timber, then compression tests were undoubtedly the best. The specimens must not be too long as compared with their cross-sectional dimensions if the pure compressive strength was to be obtained. Short timber struts very rarely gave way by direct compression; they usually gave way by shear stress. In the case of long timber struts, their strength was influenced by the

ratio of the length to the cross-sectional dimensions, exactly as in the case of steel and iron columns. The lecturer pointed out, and showed some specimens he had tested, how much weaker timber was in compression across the grain as compared with its strength when tested with the grain. He said that cross-bending tests were a very favourite form of test, because practically no complicated machine was required for carrying out the test, and large specimens could be used without the loads becoming excessive, if a fairly large span was adopted. He stated that large timber beams frequently gave way not by cross-breaking, but by shearing along near the neutral plane, and the great weakness of timber to resist such shear stress was a matter of extreme importance, and ought to be carefully considered when designing timber structures. All recent experiments on the mechanical properties of timber showed that the strength of timber was considerably affected by the ratio of the summer, or solid growth, to the spring, or open growth, in each annual ring, or in other words, that the density or specific gravity was a very important factor.

Kind of Wood.	Tension Area.	Shear Area.	Tensile Stress at Fracture.	Shear Stress at Fracture.	Method of Fracture.
	sq. in.	sq. in.	tons per sq. in.	tons per sq. in.	
Ash ...	0'764	13'52	6'62	0'37	Sheared at head. Began to shear at head, then broke in tension.
Beech ...	0'603	11'92	6'93	0'35	
Birch ...	0'804	12'80	5'36	0'34	Cracked first, then broke in tension.
Hickory ...	0'762	13'04	6'30	0'37	Sheared at head.
Mahogany	0'798	13'37	4'19	0'25	Do.
Oak	0'781	13'56	2'95	0'17	Broke in tension.

Round specimen of section with the ends so proportioned that the shear area was about $13\frac{1}{2}$ square inches, and with the bar turned down in the parallel part so as to give a tensile area of about $\frac{3}{4}$ square inch.

Kind of Wood.	Tension Area.	Shear Area.	Tensile Stress at Fracture.	Shear Stress at Fracture.	Method of Fracture.
	sq. in.	sq. in.	tons per sq. in.	tons per sq. in.	
Ash ...	1'791	8'78	2'22	0'45	Sheared at head. Do. Do.
Beech ...	1'779	8'51	2'37	0'50	
Birch ...	1'803	9'99	2'30	0'43	
Hickory ...	1'742	9'03	2'06	0'40	Sheared and then broke in tension inside head.
Mahogany	1'737	8'74	0'76	0'15	
Oak ...	1'812	8'68	1'92	0'40	Sheared at head.

Round specimens of section with the ends so proportioned that the shear area was about 9 square inches, and with the bar turned down in the parallel part so as to give a tensile area of about $1\frac{3}{4}$ square inches.

Kind of Wood.	Tensile Area.	Tensile Stress at Fracture.	Method of Fracture.
	sq. in.	tons per sq. in.	
Ash ...	0'373	4'08	Clean fracture in tension.
Beech ...	0'386	3'11	Clean fracture in tension.
Birch ...	0'385	10'14	Clean fracture in tension.
Hickory ...	0'387	7'54	Longitudinal shear.
Mahogany	0'402	5'79	Clean fracture in tension.
Oak ...	0'393	4'97	Clean fracture in tension.

Flat specimen of section test bar designed to give a tensile area of about $\frac{7}{8}$ square inch.

Kind of Wood.	DIMENSIONS OF SPECIMEN.		Total load applied.	Compressive Stress per sq. in. of cross grain area.
	Cross section of penetrating piece.	Thickness of piece penetrated.		
	sq. in.	ins.	tons.	tons.
Yellow Pine	4'42	3'3	3'5	0'79
Ash	3'42	2'2	7'0	2'04

Penetration test to show weakness of compressive strength across the grain.

Kind of Wood.	DIMENSIONS OF SPECIMEN.		Total load applied.	Compressive Stress per square inch.
	Cross sectional area.	Length of Specimen.		
	square inches.	inches.	tons.	
Beech ...	$2'3 \times 2'3 = 5'29$	12	11'4	2'16
Yellow Pine	$2'4 \times 2'4 = 5'76$	12	13'3	2'31

Compressive tests of struts about 12 in. long, and about $2\frac{1}{2}$ in. wide.

The opening meeting of the new session of the Association of Yorkshire students in connection with the Institution of Civil Engineers, was held at Leeds on November 17th.

Mr. W. J. Cudworth, M.Council Inst.C.E., who has been President of this society for the last two years, is now succeeded by Mr. Ewing Matheson, M.Inst.C.E., who gave as his opening address, a resumé of the various and principal works on which engineers are engaged.

INSTITUTION OF ELECTRICAL ENGINEERS.

SOME DIFFICULTY IN GETTING ON.

Mr. J. Swinburne, past President of this Institution, delivered an address on this subject to the students last week, of which the following is a short abstract :—

Whatever might be the case in other professions, in engineering it is quite impossible for anyone to start out with a definite career before him. Probably each man should have a general knowledge of applied physics and chemistry and mathematics, and a special knowledge of one or two subjects. The special knowledge may never come in useful; but the chances are that in the blind stumbings we call our careers, a specialty may be very valuable.

THE CRAZE FOR TECHNICAL EDUCATION.

One of the great difficulties is to keep knowledge in a polished state ready for immediate use. In practice it may have to lie idle for long periods, and then be wanted very much on short notice. This fact is overlooked by people who suffer from the modern craze for writing about technical education. The only thing to do is to treat knowledge as a huge district into which one's life is long enough to make some very little roads.

Unfortunately, education tends to become more and more unpractical as time goes on. The average science teacher has a wholly wrong view of the relations of science and business.

There is no more baneful influence in the technical advancement of the country than the Royal Society's ideal in science.

If you examine the large industries you will find the commercial or business man with little or no technical knowledge at the top of the tree. If you confine your attention to engineers, you will find the engineers who make the biggest incomes and occupy the most important and responsible positions are those who have most business or practical knowledge. Our leading consulting engineers do not spend a large portion of their lives plotting curves, counting electrons, or even making anything more than arithmetical calculations. They spend their time dealing with large questions on purely commercial lines; and as a rule the bigger the engineer the more he knows about practice and business, and the less he knows about text-book science.

JUNIOR INSTITUTION OF ENGINEERS.

The Presidential address to the Junior Institution of Engineers was delivered on Friday last by Mr. W. H. Lindley, M.Inst.C.E., who succeeds Mr. Fletcher Moulton, K.C., as president. Mr. Lindley took for his subject, "Municipal Engineering on the Continent." He said that he based his address to a great extent on the personal experiences of his father and himself, as they had stood for the past sixty years in the midst of the development. Mr. Lindley pointed out that while at the beginning of the period under review municipal engineering on the Continent stood generally under ideas derived from England, a very great and independent development has gone on and that it would be of great value for English engineers occupied in municipal works to study and follow up what was being done.

On Monday the members of the Institution paid a visit to Dudley Port and Birmingham to inspect the Central Station of the South Staffordshire Mond-Gas Company, and the Nechells Gas Works of the Corporation of Birmingham.

FARADAY SOCIETY.

An ordinary meeting was held on Wednesday evening in the library of the Institution of Electrical Engineers, when the following papers were submitted: "Recent Investigations bearing on the theory of Electrolytic Dissociation," by Professor L. Kahlenberg, and "The Potential of the Hydrogen-Oxygen Cell," by F. J. Brislee, M.Sc.

In the first-named paper, Professor Kahlenberg contended that the facts prescribed by Arrhenius (*Zeit. Phys. Chem.* 1, 629, 1887) were not sufficient to serve as a basis for the assumption of electrolytic dissociation in solutions; and that while isolated facts might here and there be interpreted by means of the dissociation theory, the bulk of experimental evidence gathered since 1887 was strongly against the theory.

Mr. Brislee's paper described experiments undertaken with the view to determining the influence of traces of persulphuric acid, hydrogen peroxide, and ozone upon the oxygen potential.

On Saturday last the Leeds Local Section of the Institution of Electrical Engineers paid a visit to Messrs. W. T. Glover's Works, Trafford Park, Manchester, and the Formby Power Station of the Lancashire and Yorkshire Railway Company.

The European business of the Blake and Knowles Steam Pump Works has recently been purchased by the Worthington Pump Co., Ltd., 153, Queen Victoria Street.

CONTRACTORS' NEWS.

We shall be pleased to insert under this column, free of charge, particulars of open contracts.

CONTRACTS OPEN.

	Last Day.
Dublin. —Iron and steel stores for Midland Great Western Railway. General stores department, Broadstone Street, Dublin ...	Nov. 28
London. —Supplying one steam motor and bogie for steam motor carriage. Agent-General, South Australia, Threadneedle House, Bishopsgate Street, E.C. ...	Nov. 28
Blackpool. —Erection of a steel water chute. Gaslick and Sykes, civil engineers, Blackpool ...	Nov. 28
Somerset. —Sinking of well in connection with the Somerset and Bath Asylum. Mr. W. Phelps ...	Nov. 30
Swansea. —Supply of motor and starting switches to the Corporation during 1905. Mr. T. Thomas, Town Clerk, Swansea ...	Dec. 1
Brentwood. —Supplying and fixing direct-acting steam duplex pump (Worthington type) for the Essex County Asylum. Medical Superintendent ...	Dec. 3
Cambrian Railway. —Supplying of six motor vehicles for omnibus service. Mr. H. E. Jones, Locomotive Superintendent, Oswestry ...	Dec. 3
Edinburgh. —Erection of City wall for the Corporation. Public Works Office ...	Dec. 5
Birmingham. —Supply of electric lamps, cables, steam valves, steel plates and sheets, cast-iron pipes, etc. Cadbury Bros., Ltd., Bournville, Birmingham ...	Dec. 5
Glasgow and South-Western Railway. —Execution of 19,000 cubic yards of dredging at Troon Harbour. F. H. Gillies, Secretary, Glasgow. ...	Dec. 5
Dublin. —Supply of general stores, including electrical supplies, car fittings, iron, steel, etc., for 1905. The Secretary, Dublin United Tramways Co., 9, Upper Sackville-street, Dublin ...	Dec. 5
London. —Supplying of iron and steel stoves for the Camberwell Borough Council. Mr. W. Oxtoby, Borough Engineer, Town Hall, Camberwell ...	Dec. 5
South Hetton. —Supplying iron and steel stoves for the South Hetton Coal Company, Mr. T. R. Lambert, South Hetton, Sunderland ...	Dec. 5
London County Council. —Supply, delivery and erection complete of three main driving gas engines with auxiliary gas engines and accessories at Falcon Brook pumping station, Battersea. G. L. Gomme, Clerk ...	Dec. 6
East Cowes (I.W.). —Laying 6-in. cast-iron main, with valves and fittings. Also one 50-h.p. engine and suction gas plant, fitted and fixed complete. Also one set of 8-in. three-throw deep-well pumps, fitted and fixed in well with 6-in. rising main and all necessary gear, etc. Mr. W. Brown, 709, High Road, Tottenham, or Mr. Albert E. Barton, Town Hall, East Cowes, Surveyor to the Council ...	Dec. 7

	Last Day.
Bangor. —Supplying the Council with gas meters for one year. The Gas Manager, Bangor, N. Wales ...	Dec. 20
Cardiff. —Competitive designs and tenders for supply of pumping machinery, and plant required in connection with the proposed western district main outfall sewer. Contract No. 1—for combined sewage pumping engines and pumps of a maximum capacity of 700,000 gallons per hour; 2—for the steam generating plant required for Contract No. 1; 3—for two sets of gas engines and centrifugal storm-water pumps, each capable of discharging 680,000 gallons per hour. Particulars at the office of Mr. W. Harper, borough engineer, Town Hall, Cardiff ...	Dec. 21
London County Council. —Installation of heating, ventilating, and hot-water plant at Long Grove Asylum, Epsom ...	Jan. 23
Liverpool. —Supplying two large turbine steamers to Elder, Dempster and Co., for Jamaica service ...	
Bromsgrove. —Supply and erection of the following plant, for the Visiting Committee of the Worcestershire County Council: (Section A) engines, dynamos, booster, and steam services; (B) storage battery and accessories; (C) main switch-board, ring main, feeders, distribution boards, wiring, lamps, and accessories. Mr. Robert J. Oliver, Clerk, Shirehall, Worcester ...	

COMING CONTRACTS.

Colchester. —An application has been made by the Corporation for permission to borrow £16,500 for purposes of electric lighting, and £740 for works of sewerage and surface-water drainage.	
Newport. —An inquiry has been held into an application of Newport Corporation for sanction to borrow £17,825 for purposes of electric lighting extensions and power supply.	
Dover. —An inquiry has been held into the Corporation's application for sanction to a loan of £24,475 for electric supply purposes.	
Finchley. —An inquiry has been held into the Council's application to borrow £17,000 for electric supply purposes.	
Sunderland. —The Corporation has decided to apply for a loan of £9,673 for tramway purposes.	
Prestwick. —The Salford Corporation has obtained the sanction of the Local Government Board to borrow £5,000 for electric supply purposes in Prestwick.	
Ashton-under-Lyne. —The Council have applied for a loan of £30,000 for extensions of the electricity undertaking.	
Aberdare. —The Council are promoting a Bill to authorise the construction and working of electric tramways.	

Accrington.—The Council are seeking powers to reconstruct and convert the existing tramways to electric traction.

CONTRACTS CLOSED.

Liverpool.—The electric and hydraulic equipment of the lighting and travelling stage of the Liverpool Olympia is being supplied by C. and A. Musker, Ltd., of Liverpool.

Rotherham.—The order for a new steel pit head for the Dennington Main Colliery Company has been given to Goddard, Massey and Warner, Nottingham. An order for a ventilating fan has been placed with the Capell Fan Company, Newcastle.

London.—The order for an instrument to record the fluctuation of the tide levels at the Surrey Commercial Docks has been placed with W. H. Bailey and Co., Ltd.

Dalmuir.—The contract for equipping the new yards of W. Beardmore and Sons, Ltd., for which over 300 pneumatic tools will be required has been placed with the Consolidated Tool Co., Ltd.

Hammersmith.—The Council have accepted the tender of Richardsons, Westgarth and Co., for a third surface condenser at £1,600; that of the Thermal Storage Company for thermal-storage plant (four vessels) at £2,616; and that of Robey and Co. for feed-water heater at £430.

Great Western Railway.—The order for troughing required in connection with Messrs. Kennedy and Jenkins' specification for the Great Western Railway electrification has been placed with the Howard Conduit Company.

Acton.—The Council have accepted tenders from the Key Engineering Company, Venner and Co., and the British Thomson-Houston Company for the supply of electricity meters.

Fulham.—The Council have accepted the tender of the British Thomson-Houston Company for a 3,000-volt main generator switchboard for £492.

London and South-Western Railway.—The company has placed an order for a harbour service steamer with Gourlay Bros. and Co., Dundee.

Newport.—The cables for the transporter suspension bridge are being supplied by W. B. Brown and Co., Liverpool. The total weight is over 350 tons.

APPOINTMENTS VACANT.

	Last date for application.
London. —Assistant secretary to the British Association for the advancement of Science. Salary £300	Dec. 2
West Ham. —Demonstrator in Mechanical Engineering at Municipal Technical Institute. Salary, £150 per annum ...	Dec. 5
Manchester. —Assistant civil engineer for Corporation tramways — also junior draughtsman	Nov. 26

Manchester.—Assistant civil engineer and junior draughtsman in the tramway's offices Nov. 26

Sheffield.—Resident engineer in connection with construction of water tunnel in the Rivelin Valley Nov. 28

Sheffield.—Engineer under the Corporation, Mr. H. Sayer, Town Clerk Nov. 28

Leigh.—Chief engineer and manager of electricity undertaking. Commencing salary £250 Nov. 29

London.—Assistant in Mechanical Engineering department—Northampton Institute, St. John's-road, E.C. Salary £150... Nov. 30

APPOINTMENTS FILLED.

London.—Dr. Frederick Rose, H.B.M. Consul at Stuttgart, has been appointed assistant educational adviser to the Education Committee of the London County Council.

Huddersfield.—Mr. W. E. Curnock, of the Northampton Institute, Clerkenwell, has been appointed head of the engineering department at the Technical College.

Bermondsey.—Mr. J. G. Doran, of Southampton, has been appointed chief assistant electrical engineer at the electricity works.

Belfast.—Mr. Acheson Ferguson has been appointed by the Tramways and Electricity Committee of the City Council, quantities surveyor in connection with the new generating station.

Blackburn.—Mr. J. H. Cowell, traffic manager, and Mr. L. Johnston, assistant tramway engineer, have been appointed joint managers of the Corporation tramways. The appointments arise out of the decision of the Town Council to separate the management of the tramways undertaking from that of the electricity works. Each gentleman will receive a salary of £250 per annum. Mr. P. P. Wheelwright, chief assistant electrical engineer, becomes electrical engineer and manager of the electricity department, at a salary of £300 per annum; and the salary of Mr. F. H. Corson, electricity station superintendent, has been increased to £250 a year.

Metropolitan Railway.—Two officials of the Glasgow Corporation tramways have been offered, and have accepted, appointments under their old chief, Mr. John Young, in London. They are Mr. James B. McKinnon, head of the time-table department, who has accepted an important secretarial position; and Mr. A. Agnew, chief motor instructor at Coplawhill depot, who has been appointed to the electrical engineering staff of the Metropolitan railways.

Leeds.—Mr. S. Ball, who for the last twelve years has been under-manager of the steel rolling mills of Messrs. John Spencer and Sons, Limited, at Newburn-on-Tyne, has been appointed manager of the Leeds Forge, Armley Road, Leeds.

Share List of Engineering, Electrical, Iron and Steel, and other Companies.

The following is a comprehensive list of Companies in the industries covered by "Page's Weekly," in which shares business is being currently transacted. Additions will be made from time to time as occasion requires. We desire it to be understood that while our Share List will generally be found correct, we do not hold ourselves responsible for any loss or inconvenience that may arise from possible inaccuracies.

STOCK EXCHANGE SETTLING DAYS.—Settling days on the Stock Exchange are as follows:—

Consols: December 1st. General Settlements: November 30th, December 15th, 30th. Bank Rate, April 21st, 3 per cent.

I.—ENGINEERING, IRON, AND STEEL COMPANIES.

ENGINEERING, IRON, AND STEEL COMPANIES.—Contd.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
3,210,000	1	2/8	Armstrong (Sir W. G.), Whitworth and Co., Ltd.	1	3 — 3½
78,970	5	2/-	Do. 4% Cum. Pref.	5	5½ — 5½
1,500,000	100	4%	Do. 4% 1st Mort. Dbs. Red.	100	102 — 104
£100,000	100	4½%	Aveling and Porter, Ltd., 4½% Reg. Mt. Dbs. Red.	100	97 — 100
530,000	1	1/7½	Babcock and Wilcox, Ltd., Ord.	1	3½ — 3½
100,000	1	7½d.	Do. 6% Cum. Pref.	1	1½ — 1½
20,000	5	3/-	Baker (Joseph) and Sons, Ltd., 6% Cum. Pref.	5	5 — 5½
250,000	1	6½d.	Baldwins, Ltd., 5½% Cum. Pref.	1	1 — 1½
£250,000	Stk	4½%	Do. 1st Mt. 4½% Deb. Stk. Red.	100	101 — 103
150,000	4½	2/8½	Barrow Haematite Steel Co., Ltd., O. Do.	4½	1 — 1½
50,000	4½	6/-	Do. 10% Cum. Pref.	4½	3½ — 4
33,334	5	2/6	Bayliss, Jones and Bayliss, Ltd., 6% Cum. Pref. Shares	5	4½ — 5½
£500,000	100	—	Beardmore (Wm.) & Co., Ltd., 4½% 1st Mt. Dbs., Red., Scrip 50% pd	—	50 — 52
50,000	10	6/-	Bell Brothers, Ltd., 6% Cum. Pref.	10	11½ — 12½
£365,600	Stk	4%	Do. 4% Deb. Stk. Red.	100	99 — 102
149,850	1	6d.	Bengal Iron and Steel Ord.	1	7 — 1½
201,000	1	1/-	Beyer, Peacock and Co., Ltd., Ord.	1	7 — 1½
300,000	1	6½d.	Do. 5½% Cum. Pref.	1	3½ — 4
£300,000	Stk	4½%	Do. 4½% Red. Deb. Stock	100	96 — 99
1,629,760	1	6d.	Boickow, Vaughan and Co., Ltd., O. Nos. 1-1,629,760	1	7 — 1
1,860,900	1	3½d.	Do. Nos. 1,631,101-3,500,000	12½	2 — 2½
1,160,000	1	9d.	Brown (John) and Co., Lim., Or. Nos. 1-1,160,000	15½	1½ — 1½
590,000	1	1/-	Do. Ord., Nos. 1,160,001-1,750,000	1	1½ — 1½
74,000	10	5/-	Do. 5% Cum. Pref.	10	11 — 11½
154,500	5	2/6	Cammell, Laird & Co., Ltd., Ord.	5	7½ — 8
232,500	5	2/6	Do. 5% Cum. Pref.	5	5½ — 5½
450,000	1	1/6	Clayton & Shuttleworth, Ltd., Ord.	1	5½ — 5½
70,000	5	2/6	Do. 5% Cum. Pref.	5	5½ — 5½
£250,000	Stk	4%	Do. 4½ 1st Mort. Db. Stk. Red	100	100 — 102
100,000	10	30/-	Conssett Iron Co., Ltd., Ord.	7½	30 — 32
230,000	5	6/-	Cory (Wm.) & Son, Ltd., Ord.	5	7½ — 7½
170,000	5	2/6	Do. 5% Cum. Pref.	5	6 — 6½
£725,400	Stk	4%	Do. 4½ 1st Mort. Db. Stk. Red	100	104 — 106
1,259,594	1	3½d.	Dorman, Long & Co., Ltd.	1	3½ — 3½
£400,000	Stk	4%	Do. 4% 1st Mort. Perp. Deb. Stk. Red.	100	93 — 96
£250,000	Stk	—	Do. 6% 2nd Mort. Deb. Stk. Red. Prov. Cts. 60% pd.	—	56 — 58
273,000	1	1/-	Dundee Coal Co., Ltd. (Natal)	1	1½ — 1½
200,000	5	3/-	Dunderland Iron Ore Co., Ltd., 6% Cum. Pref. and Participating	5	3 — 3½
250,000	1	9½d.	Dunlop (James) & Co., Ltd., Ord.	1	1 — 1
300,000	1	7½d.	Do. 6% Cum. Pref.	1	1½ — 1½
4,721	15	12/-	Ebbw Vale Steel, Iron & Coal Co., Ltd.	13	8½ — 9½
69,754	13	12/-	Do. do. do.	10	7½ — 7½
25,000	10	6/-	Fairfield Shipbuilding & Engng. Co., Ltd., 6% Cum. Pref.	10	10½ — 11
£250,000	Stk	4½%	Do. 4½ Mort. Deb. Stk. Red.	100	99 — 102
126,000	3	3/-	Fraser & Chalmers, Ltd., Ord.	3	4½ — 5
21,000	8	4/6	Do. 7½% Cum. Pref.	3	4½ — 6
965,000	1	1/-	Guest, Keen & Nettlefolds, Ltd. Ord.	1	2½ — 2½
344,000	5	2/6	Do. 5% Cum. Pref.	5	5½ — 6½
£1,850,500	Stk	4%	Do. 4% Irred. Mort. Deb. Stk	100	105 — 107
18,000	5	2/6	Gwynnes, Ltd., 5% Cum. Pref.	5	2½ — 3½
250,000	1	—	Hadfield's Steel Fy. Co., Ltd., Ord.	1	2½ — 3½
20,000	10	4/6	Do. 4½% Cum. Pref.	10	10½ — 11
30,000	5	3/-	Hall (J. & E.), Ltd. 6% Cum. Pref.	5	5 — 5½
408,505	1	1/6	Harvey United Steel Co., Ltd.	1	1 — 1½
28,001	5	7/-	Head, Wrightson & Co., Ltd.	5	4½ — 5
85,000	1	7½d.	Hill (Richard) & Co. (1899) Ltd., Ord	1	4½ — 5
18,000	5	3/-	Do. 6% Cum. Pref.	5	4½ — 4½
30,000	10	8/-	Hornsby (Richard) & Sons, Ltd., Ord.	8	6½ — 6½
750,000	1	10½d.	Howard & Bullough, Ltd., Ord.	1	1½ — 1½
25,000	10	6/-	Do. 6% Pref. (Non-Cum.)	10	12½ — 13½
£250,000	Stk	4%	Do. 4% Deb. Stk., Red. after 1905	100	96 — 99
300,000	1	4½d.	Lambert Bros., Ltd., Ord.	1	4 — 4
50,000	5	2/9	Do. 5½% Cum. Pref.	5	4 — 4½
40,000	3	2/1½	Leeds Forge Co., 7% Cum. Pref.	3	3½ — 4½
£6,810,000	£1,000	5%	Lehigh Valley Coal Co., 1st Mort. 5% Guar. Gold Coup. Bds.	—	113 — 117

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
200,000	1	7½d.	Lysaght (John), Ltd., 6% Cum. Pf.	1	1½ — 1½
£300,000	Stk	4½%	Do. 4½ 1st Mt. Deb. Stk., Re l.	100	108 — 110
40,000	10	5/-	Mather & Platt, Ltd., 5% Cum. Pref.	10	10½ — 11½
210,000	1	6d.	Measures Bros., Ltd., Ord.	1	9 — 11
75,000	1	6½d.	Do. 5½% Cum. Pref.	1	13½ — 18
£75,000	Stk	4½%	Do. 4½ 1st Mort. Do. Stk., Red.	100	96 — 100
5,000	62½	47/6	Nantyglo and Blairston Iron Work, Ltd., 8% Cum. Pref.	62½	69 — 71
11,518	20	8/-	New Sharlston Collieries Co., Ltd. P.	20	14 — 15
73,000	10	5/-	N. Brit. Loco. Co., Ltd., 5% Cum. Pf.	10	11½ — 12
80,000	5	—	North-Eastern Steel Co., Ltd., Ord.	5	—
£250,000	Stk	4½%	Do. 4½ 1st Mt. Db. Stk. Red.	100	92 — 95
120,000	5	5/-	North's Navig. Collieries ('89), Ltd., O	5	5½ — 6½
10,000	5	5/-	Do. 10% Cum. Pref.	5	9½ — 10
122,000	5	2/-	Pearson & Knowles Coal and Iron Co., Ltd., Ord., "B"	5	3½ — 3½
50,000	5	3/-	Do. 6% Cum. Pref. "A"	5	5½ — 6½
70,000	10	6/-	Pease & Partners, Ltd., Ord.	10	8 — 9
£400,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	97 — 100
20,000	5	3/-	Peebles (Bruce) & Co., Ltd., 6% Cum. P.	5	4½ — 5
230,000	1	—	Projectile Co. (1902), Ltd., Ord.	1	1 — 1½
126,938	5	2/-	Rhymney Iron Co., Ltd.	5	1 — 1½
73,062	5	2/-	Do. New	5	1 — 1½
£330,000	—	5%	Do. 5% Mort. Deb. Red.	100	101 — 104
350,000	1	7½d.	Richardsons, Westgarth & Co., Ltd., 6% Cum. Pf.	1	7 — 1*
£350,000	Stk	4½%	Do. 4½ Perp. Deb. Stock	100	94 — 97
90,000	5	2/3	Rickett, Cockerell & Co., Ltd. 4½% C.P.	5	4½ — 4½
150,000	1	3½d.	Russian Collieries, Ltd., 7% Cum. Pf.	1	9½ — 9½
85,000	10	1½/-	Ruston, Proctor & Co., Ltd.	10	9½ — 9½
275,000	1	6d.	Scott (Walter), Ltd., Ord.	1	1 — 1
300,000	1	7½d.	Do. 6% Cum. Pref.	1	1 — 1½
£800,000	Stk	4½%	Do. 4% Perp. Deb. Stk.	100	95 — 97
£115,300	100	5%	Shelton Iron, Steel and Coal Co., Ltd. 1st Charge 5% Dbs. Red.	100	91 — 94
£97,900	100	6%	Do. 6% 2nd Mort. Dbs. Red.	100	90 — 95
7,500	10	6/-	Sneyd Collieries, Ltd., 6% Cum. Pref.	10	9½ — 10½
93,800	100	5%	Do. 5% Dbs. (Reg.) Red.	100	100 — 102
250,000	1	1/-	South Durham Steel & Iron, Ltd. Or.	1	1 — 1½
300,000	1	7½d.	Do. 6% Cum. Pref.	1	1 — 1½
£300,000	Stk	4½%	Do. 4½ Per. Deb. Stock	100	70 — 73
50,000	10	10/-	South Hetton Coal Co., Ltd., Ord.	10	17 — 19
30,000	10	5/-	Do. 5% Non-Cum. Pref.	10	9½ — 10½
25,000	10	5/-	Stephenson (Robert) & Co., Ltd., Or.	10	18 — 18
35,000	10	5/6	Do. 5½% Cum. Pref.	10	3 — 4
£250,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	74 — 76
85,000	10	9/-	Stewarts & Lloyds, Ltd., Ord.	10	16½ — 17½
55,000	10	6/-	Do. 6% Cum. Pref.	10	14 — 14½
634,732	1	4.69d.	Swan, Hunter & Wigham-Richardson, Lim. Ord.	1	7 — 1
593,845	1	6d.	Do. 5% Cum. Pref.	1	1½ — 1½
£240,000	Stk	4½%	Do. 4½ 1st Mort. Deb. Stk. Red	100	98 — 101
300,000	1	6d.	Thames Iron Works, Shipbuilding & Engineering Co., Ltd., 5% Cum. Pf.	1	—
£200,000	100	4%	Do. 4% Irred. 1st Mort. Deb.	100	66 — 70
£160,000	1	7½d.	Thornycroft (John I.) & Co., Ltd.	1	—
10,000	10	5/-	Taylor (J.) & Sons, Ltd. 5% Cum. Pf.	10	18 — 18*
£92,900	100	5%	United Collieries, Ltd., 5% Dbs.	100	65 — 70
£504,952,000	£100	8½	United States Steel Corp. Com. Stk	£100	28½ — 28½
£360,314,100	£100	8½	Do. 7% Cum. Pref. Stock	£100	91½ — 91½
£162,288,000	£1000	5	Do. 10-60yr. 5% Skg. Fd. G. Bds.	£1000	91 — 93
3,350,000	1	1/-	Vickers, Sons & Maxim, Ltd. Ord.	1	2½ — 2½
750,000	1	6d.	Do. 5% Non-Cum. Pref.	1	1½ — 1½
£1,250,000	Stk	5%	Do. 5% Non-Cum. Pref. Stock	100	110 — 114
£1,000,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	102 — 104*
225,000	1	1/2½	Do. 4½ 2nd Mort. Dbs., Red.	100	104 — 106
500,000	1	7½d.	Weardale Steel, Coal & Coke, Ltd., Def. Ord.	1	—
£300,000	Stk	4%	Do. 6% Cum. Pref. Ord.	1	—
65,666	5	3/-	Do. 4% Perpetual Deb. Stock	100	79 — 82
65,666	5	3/-	Willans & Robinson, Ord.	5	1 — 2
£216,641	Stk	4%	Do. 6% Cum. Pref.	5	2 — 3
£150,000	Stk	4½%	Do. 4% 1st Mort. Deb. Stk. Red	100	75 — 80
			Yorkshire Iron & Coal Co., Ltd., 4½ 1st Mort. Deb. Stk. Red.	100	80 — 85

Stocks and Shares marked * are quoted ex-dividend.

II.—ELECTRICAL MANUFACTURING COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
70,000	1	6d.	Alliance Elec. Co., Ltd. 5% Cum. Pf.	1	8 — 7
125,000	1	7½d.	Aron Elec. Meter Ltd., 6% Cum. Pf.	1	7 — 7
120,000	1	9½d.	Bell's Asbestos Co., Ltd.	1	17 — 18
100,000	5	4/-	British Insulated & Helsby Cables, Ltd., Ord.	5	54 — 6
100,000	5	3/-	Do. 6% Cum. Pref.	5	54 — 6
£500,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Rd.	100	101 — 104
£200,000	Stk	4½%	British Thomson-Houston Co., Ltd., 4½% 1st Mort. Deb. Stk. Rd.	100	100 — 102
400,000	5	3/-	British Westinghouse Electric and Manufac. Co., Ltd., 6% Pref.	5	38 — 38
£616,353	Stk	4%	Do. 4% Mort. Deb. Stk. Rd.	100	89 — 91
35,000	5	5/-	Callender's Cable & Constn. Ltd. Ord.	5	9 — 10
40,000	5	2/6	Do. 5% Cum. Pref.	5	5 — 5½
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Rd.	100	104 — 106
52,000	5	10/-	Dick, Kerr & Co., Ltd., Ord.	5	7 — 7½
61,000	5	3/-	Do. 6% Cum. Pref.	5	5½ — 5½
£300,000	Stk	4½%	Do. 4½% Deb. Stock, Red.	100	104 — 106
233,334	1	6d.	Doulton & Co., Ltd., 5% Cum. Pref.	1	1½ — 1½
£233,334	Stk	4%	Do. 1st Mort. 4% Iree. Deb. Stk.	100	106 — 109
99,261	5	1/6	Edison and Swan United Electric Light, Ltd., "A" Shares	8	1 — 1½
17,139	5	2/6	Do. "A" Shares Nos. 01-017,139	5	1 — 1½
£344,023	Stk	4%	Do. 4% Deb. Stock Red.	100	78 — 80
£100,000	Stk	5%	Do. 5% Second Deb. Stk. Red.	100	79 — 84
112,100	2	1/7½	Electric Construction Co., Ltd.	2	1½ — 1½
81,390	2	2/9½	Do. 7% Cumulative Pref.	2	2 — 2½
£200,000	Stk	4%	Do. 4% Perp. 1st Mt. Deb. Stk.	100	98 — 100
10,248	10	7/6	Evered and Co., Ltd.	10	19 — 15
£100,000	Stk	5%	Ferranti, Ltd., 5% 1st Mort. Deb. Stock, Red.	100	90 — 95
25,000	10	5/-	Gen. Elect. Co. (1900), Ltd., 5% Cum. Pref.	10	9½ — 10
£200,000	Stk	4%	Do. 4% 1st Mt. Deb. Stk., Red.	100	91 — 96
35,000	5	5/-	Henley's (W. T.) Telegraph Works Co., Ltd., Ord.	5	10½ — 11½
35,000	5	2/3	Do. 4½% Cum. Pref.	5	5 — 5½
£50,000	Stk	4½%	Do. 4½% Mt. Deb. Stk. Red.	100	109 — 111
50,000	10	5/-	India Rubber, Gutta Percha & Telegraph Works Co., Ltd., 1st Mort. Deb. Red.	10	19½ — 20½
£300,000	100	4%	Do. 1st Mort. Deb. Red.	100	99 — 102
37,350	12	12/-	Telegraph Construction and Maintenance Co., Ltd.	12	36 — 39
£150,000	100	4%	Do. 4% Deb. Bonds	100	102 — 104

III.—ELECTRIC TRACTION.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
120,000	5	3/-	Anglo-Argentine Trams Co., Ltd., Ord.	5	67 — 7½
260,007	5	2/6	Do. 5% Cum. Pf.	5	7½ — 5½
£230,000	Stk	6%	Do. Permanent 6% Debenture Stock, 1888	100	143 — 146
£200,000	Stk	5%	Auckland Electric Trams Co., Ltd., 5% 1st Mort. Deb. Stock, Red.	100	105½ — 106½
20,000	10	6/-	Barcelona Trams Co., Ltd., Ord.	10	9 — 10
10,000	10	5/-	Do. 5% Cum. Pf. Shares	10	9 — 10
£46,300	100	5%	Do. 5% Debts., Red.	100	98 — 101
£191,325	Stk	4½%	Do. 4½% Red. Deb. Stk.	100	91 — 96
75,616	1	—	Bath Elec. Trams, Ltd., Pf. Or.	1	8 — 8
59,394	1	—	Do. 5% Cum. Pf.	1	16 — 17
75,000	5	—	Brisbane Electric Tram Investment Co., Ltd., Ord.	5	1½ — 2½
75,000	5	2/6	Do. 5% Cum. Pf.	5	3 — 4
£425,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	96 — 100
£210,000	Stk	6%	Brit. Columbia Elec. Rly. Co., Ltd., Def. Ord. Stk.	100	100 — 103*
£200,000	Stk	5%	Do. Pref. Ord. Stock	100	102 — 105
7,500	10	5/-	Do. 5% Cum. Perp. Pf.	10	10½ — 10½
£242,800	40	4½%	Do. 4½% 1st Mort. Debts.	40	102 — 104*
£220,000	100	4½%	Do. 4½% Vancouver Power Db.	100	97 — 100
139,301	10	6/-	Brit. Electric Traction, Ltd., Ord.	10	9½ — 10½
156,437	10	6/-	Do. 6% Cum. Pref.	10	10½ — 11
£1,000,000	Stk	5%	Do. 5% Perp. Deb. Stk.	100	117 — 119
£250,000	Stk	4½%	Do. 4½% 2nd Deb. Stk., Red.	100	95 — 97
100,000	5	1/6	Buenos Ayres & Belgrano Electric Trams, Ltd., Ord.	5	3½ — 4
40,500	5	3/-	Do. "A" 6% Cum. Pref.	5	5½ — 5½
27,000	5	3/-	Do. "B" do.	5	5½ — 5½
£820,000	Stk	5%	Do. 5% Deb. Stk., Red.	100	106 — 108
£160,000	Stk	5%	Do. 5% 2nd Deb. Stk., Red.	100	102 — 105
£200,000	Stk	5%	Buenos Ayres Elec. Trams Co. (1901) Ltd., 5% Db. Stk., Red.	100	96 — 99
£220,000	100	6%	Buenos Ayres Gd. Nat., Ltd., 6% 1st Deb. Bd.	100	97 — 100
£150,000	100	5½%	Do. 5½% Pref. Debts.	100	100 — 104

Stocks and Shares marked * are quoted ex-dividend

ELECTRIC TRACTION.—Contd.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
102,268	5	3/-	Calcutta Tramways Co., Ltd.	5	7½ — 7½
£350,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	106 — 108
480,000	1	1/-	Cape Electric Tramways, Ltd.	1	1½ — 1½
40,000	5	2/6	City of Birmingham Trams Co., Ltd., 5% Cum. Pref.	5	4½ — 5
£300,000	100	4%	Do. 4% 1st Mort. Debts.	100	98 — 101
155,000	5	4/-	City of Buenos Ayres Trams Co., Ltd.	5	10½ — 10½
£116,000	Stk	6%	Do. Per. 6% Deb. Stk.	100	140 — 145
£120,000	Stk	5%	Colombo Elec. Tram. & Light. Co., Ltd., 6% 1st Mort. Deb. Stk. Red.	100	101 — 104
60,000	10	6/-	Dublin United Trams. Co. (1896), Ltd., Ord.	10	13 — 14
59,987	10	6/-	Do. 6% Pref.	10	15 — 16
30,000	5	2/6	Isle of Thanet Elec. Trams. and Light. Co., Ltd., 5% Cum. Pref.	5	32 — 32
£150,000	Stk	4%	Do. 4% Deb. Stock	100	90 — 93
125,000	10	5/-	London United Trams. (1901), Ltd., 5% Cum. Pref.	10	10½ — 10½
£1,031,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	104 — 106
£50,000	Stk	—	Madras Electric Trams (1904), Ltd., 5% Deb. Stock, Red.	100	103 — 105
314,016	1	6d.	Metropolitan Elec. Trams, Ltd., Def.	1	8 — 1
500,000	1	6d.	Do. 5% Cum. Pref.	1	8 — 1
£350,000	Stk	13/7	Do. 4½% Deb. Stock, Red.	100	103 — 105
50,000	5	6/-	New General Traction Co., Ltd., 6% Cum. Pref.	5	3 — 1½
110,923	8	2/9½	North Metropolitan Tramways Co., Ltd.	8	32 — 32
£150,000	100	8½%	Do. 8½% Mort. Debts.	100	87 — 93
£196,200	Stk	8½%	Perth Electric Trams, Ltd. (W.A.), 5% 1st Mort. Deb. Stock, Red.	100	103 — 106
24,500	10	10/-	Potters Elec. Traction Co., Ltd., Or.	10	8 — 9
24,500	10	5/-	Do. 5% Cum. Pref.	10	8 — 9
£220,000	Stk	4½%	Do. 4½% Deb. Stk., Red.	100	99 — 102*

IV.—ELECTRIC LIGHTING AND POWER.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
7,500	10	16/-	Bournemouth & Poole Elec. Sup. Co., Ltd., Ord.	10	11½ — 12½
7,500	10	4/6	Do. 4½% Cum. Pref.	10	9½ — 10
7,500	10	6/-	Do. 6% Cum. Second Pf.	10	11 — 12
£70,000	Stk	4½%	Do. 4½% Deb. Stock Red.	100	104 — 106
14,000	5	2/-	Bromley (Kent) Elec. Lt. & Pr. Co. Ltd.	5	5½ — 5½
£50,000	Stk	4½%	Do. do. 4½% 1st Deb. Stk. Red.	100	101 — 104
27,507	5	4/6	Brompton & Kensington Elec. Supply Co., Ltd., Ord.	5	10½ — 11
12,493	5	3/6	Do. 7% Cum. Pref. Shares	5	10½ — 10½
105,731	2	2/4	Brush Elec. Enging. Co., Ltd., Ord.	2	2 — 2½
150,000	2	2/4½	Do. 6% Pref.	2	1 — 1½
£125,000	Stk	4½%	Do. 4½% Perp. 1st Deb. Stk.	100	93 — 96
£125,000	Stk	4½%	Do. 4½% Perp. 2nd Deb. Stk.	100	69 — 73
60,000	5	3/-	Calcutta Elec. Sup. Cor. Ltd., Ord.	5	7½ — 8
£288,782	Stk	4%	Central Elec. Sup. Co., Ltd., 4% Gaa. Deb. 8 k.	100	106 — 109
70,000	5	4/-	Charing Cross & Strand Elec. Sup. Corp., Ltd., Ord.	5	8½ — 9
10,000	5	—	Do. do. Ord.	5	8 — 8½
80,000	5	2/3	Do. do. 4½% Cum. Pref.	5	5½ — 5½
£350,000	Stk	4%	Do. do. 4½% Deb. Stk. Red.	100	103 — 105
40,000	5	2/3	Do. do. "City Undertaking"	5	4½ — 5
40,000	5	2/3	Do. do. do. (1903)	5	4½ — 5
44,436	5	2/3	Chelsea Elec. Soly. Co., Ltd., Ord.	5	6½ — 6½
£150,000	Stk	4½%	Do. do. 4½% Deb. Stk., Red.	100	108 — 111
70,595	10	5/-	City of London El. Lghg. Co., Ltd., Ord.	10	10½ — 11
40,000	10	6/-	Do. 6% Cum. Pref.	10	13 — 14
£400,000	Stk	5%	Do. 5% Deb. Stk., Red.	100	123 — 127
£300,000	Stk	4½%	Do. 4½% 2nd Deb. Stk., Red.	100	104 — 106
40,000	10	4/-	County of London Elec. Supply Co., Ltd., Ord.	10	9 — 10
30,000	10	6/-	Do. 6% Cum. Pref.	10	12 — 12½
£400,000	Stk	4½%	Do. 4½% Deb. Stk., Red.	100	106 — 109
£250,000	—	4½%	Do. 4½% 2nd Deb. Stk., Priv. Crts. all paid, Red.	100	101 — 103
85,000	3	1/6	Crompton & Co., Ltd.	3	1½ — 1½
£100,000	—	5%	Do. 5% 1st Mort. Reg. Debts.	100	90 — 95
70,000	5	4/6	Edmundson's Elec. Cor. Ltd., Ord.	5	5½ — 6
70,000	5	3/-	Do. 6% Cum. Pref.	5	5½ — 6
£300,000	Stk	4½%	Do. 4½% 1st Mort. Db. Stk. Red.	100	106 — 108
£80,000	Stk	5%	Electric Lighting & Traction Co. of Australia, Ltd. 5% Deb. Stk. Red.	100	88 — 93
19,000	5	2/-	Folkestone Elec. Supply Co., Ltd., Ord.	5	5½ — 6
£50,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	102 — 105
15,000	10	—	Havana Electricity Co., Ltd.	10	9½ — 10½
18,000	5	3/8	Hove Elec. Lighting Co., Ltd., Ord.	5	7½ — 8
£50,000	Stk	4½%	Isle of Wight Electric Light & Power Co., Ltd. 4½% Deb. Stock, Red.	100	99 — 101

ELECTRIC LIGHTING AND POWER.—Contd.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
150,000	1	—	Kalgoorlie Electric Power & Lighting Corp., Ltd., 6% Cum. Pref.	1	7½ — 7½
21,000	5	5/-	Kensington and Knightsbridge Electric Lighting Co., Ltd., Ord. . .	5	12 — 13
£135,000	8½k	4%	Kensington and Knightsbridge Electric Lighting Co., Ltd., and the Notting Hill Electric Lighting Co., Ltd., 4% Deb. Stock, Red.	100	102 — 104
111,000	3	—	London Elec. Supply Corp., Ltd., Ord.	3	2 — 2½
60,000	5	3/-	Do. 6% Pref.	5	5½ — 6
£371,895	Stk	4%	Do. 4½ 1st Mort. Db. Stk., Red.	100	97 — 99
100,000	10	9/-	Metropolitan Elec. Sup. Co., Ltd., Ord.	10	16 — 16½
76,121	5	2/3	Do. 4½ Cum. Pref.	5	5½ — 5½
220,000	Stk	4½%	Do. 4½ 1st Mort. Db. Stk., Red.	100	112 — 117
250,000	Stk	3½%	Do. 3½ Mort. Deb. Stk., Red.	100	97 — 99
£250,000	—	4½%	Midland Elec. Corp. for Power Distribution on Ld., 4½ 1st Mort. Deb.	100	93 — 96
10,852	10	6/-	Notting Hill Elec. Ltg. Co. Ltd., Ord.	10	14½ — 15
£59,000	100	4%	Do. 4% 1st Mort. Debs. . .	100	101 — 103
16,500	5	2/6	Oxford Electric Co. Ltd., Ord.	5	6 — 6½
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	99 — 101
£84,700	100	4½%	Royal Elec. Co. (of Montreal) 4½ 20-yr. 1st Mort. Deb.	100	100 — 102
40,000	5	5/-	St. James' & Pall Mall Elec. Light Co., Ltd., Ord.	5	14 — 15
20,000	5	3/6	Do. 7% Pref. . .	5	8½ — 9
£150,000	Stk	3½%	Do. 3½ Deben. Stock, Red	100	99 — 101
12,000	5	4/-	Smithfield Markets Elec. Supply Co., Ltd., Ord.	5	23 — 24
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	83 — 87
65,000	5	3/-	South London Elec. Sup. Co., Ltd., O.	5	44 — 4½
100,000	1	—	South Metropolitan Elec. Light & Power Co., Ltd., Ord.	1	2 — 1
50,000	1	8½d.	Do. 7% Cum. Pref. . .	1	1½ — 1½
£100,000	Stk	4½%	Do. 4½ 1st Deb. Stock Red.	100	107 — 110
50,000	5	2/6	Urban Electric Supply Co., Ltd., O.	5	41½ — 5½
90,000	5	2/6	Do. 5% Cum. Pref.	5	41½ — 5½
£200,000	Stk	—	Do. 4½ 1st Mort. Deb. Stk. Red	100	103 — 105
110,000	5	6/6	Westminster Elec. Supply Corp. Ltd., Ord.	5	12½ — 13½
28,151	5	2/6	Do. 5% Cum. Pref. . .	5	6½ — 7

VI.—SHIPPING COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£34,800	100	2½%	African Direct Tel. Co., Ltd., 4% Mt. Debs. (Series A), Red. . .	100	99 — 102
25,000	10	—	Amazon Telegraph Co., Ltd. . .	10	1 — 1½
£763,580	Stk	12/6	Anglo-American Tel. Co., Ltd., Ord.	100	56 — 58
£3,118,210	Stk	25/-	Do. 6% Preferred Ordinary . .	100	102 — 104
£3,118,210	Stk	2/-	Do. Deferred Ordinary . .	100	12½ — 12½
44,000	5	4/-	Chili Telephone Co., Ltd. . .	5	5½ — 5½
£15,000,000	£100	3½%	Commercial Cable Co., Capital Stk.	£100	170 — 190
£1,903,856	Stk	4%	Do. Sterl. 500-yr 4% Deb. Stk., Red.	100	92 — 95
16,000	10	5/-	Cuba Submarine Tel. Co., Ltd., Ord.	10	7½ — 7½
6,000	10	10/-	Do. 10% Preference . .	10	14 — 15½
6,000	5	5/-	Direct Spanish Telegraph Co., Ltd., 10% Cum. Preference	5	7 — 8
£30,000	50	4½%	Do. 4½ Debs. . .	50	98 — 101½
60,710	20	3/-	Direct U.S. Cable Co., Ltd., . .	20	10½ — 11½
£85,800	100	4½%	Direct West India Cable Co., Ltd., 4½ Reg. Debs.	100	100 — 102
£300,000	100	4%	East. & S. African, Ltd., 4% Mt. Dbs.	100	101 — 103
£200,000	25	4%	Do. 4% Rg. Mt. Dbs. (Mauritius Subsidy) . .	25	100 — 102½
800,000	10	2/6	Eastern Extension, Australasia and China, Ltd., . .	10	13 — 13½
£602,400	Stk	4%	Do. 4% Mort. Deb. Stk., Perp.	100	106 — 108
£4,000,000	Stk	25/-	Eastern Tele. Co., Ltd., Ord.	100	133 — 136
£2,000,000	Stk	17/6	Do. 3% Pref. . .	100	88 — 90
£1,896,814	Stk	4%	Do. 4% Mort. Deb. . .	100	105 — 107
150,000	10	5/-	Great Southern Telegraph Co., Ltd., (of Copenhagen) . .	10	28 — 28½
£58,700	100	4½%	Halifax and Bermuda Cable Co., Ltd., 4½ 1st Mort. Debs. Red.	100	100 — 102
17,000	25	12/6	Indo-European Tele. Co., Ltd., . .	25	44 — 47
72,680	1	7½d.	Monte Video Telephone Co., Ltd., O.	1	20 — 20
£1,983,333	Stk	6%	National Telephone Co., Ltd., Pref.	100	105 — 108
£1,966,667	Stk	5/-	Do. Deferred . .	100	96 — 98
15,000	10	6/-	Do. 6% Cum. 1st Pref. . .	10	13 — 14
15,000	10	6/-	Do. do. 2nd do. . .	10	12 — 13
250,000	5	2/6	Do. 5% Non-Cum. 3rd Pref. . .	5	5½ — 5½
£2,000,000	Stk	3½%	Do. 3½ Deb. Stk., Red. . .	100	97 — 99
£689,593	Stk	4%	Do. 4% do. do. . .	100	104 — 106
£1,000,000	—	5/9	Do. 4% Prov. Certs. 35% to be paid . .	—	67½ — 68½
179,313	1	7½d.	Oriental Telephone & Elec. Co., Ltd.	1	1½ — 1½
50,000	1	7½d.	Do. 6% Cum. Pref. . .	1	1½ — 1½

TELEGRAPHS AND TELEPHONES.—Contd.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£100,000	100	4%	Pacific & European Tel. 4% Guar. Debs. Red. . .	100	93 — 100
11,839	8	4/-	Reuter's Telegram Co., Ltd. . .	8	6½ — 7½
59,000	5	5/-	United River Plate Telep. Co., Ltd.	5	68 — 68
40,000	5	2/6	Do. 5% Cum. Pref. . .	5	5½ — 5½
£179,947	Stk	5%	Do. 5% Deb. Stock, Red. . .	100	104 — 106
15,609	10	6/-	W. African Telegraph Co., Ltd. . .	10	7 — 7½
30,008	2½	—	West Coast of America, Ltd. . .	2½	5 — 5½
£150,000	100	4%	Do. 4% Deb. Guar. by West. Tel.	100	98 — 100
88,321	10	6d.	W. India & Panama Telep. Co., Ltd., Or.	10	8 — 8½
34,563	10	6/-	Do. 6% Cum. 1st Pref. . .	10	7½ — 7½
4,669	10	6/-	Do. 6% Cum. 2nd Pref. . .	10	5 — 6
£80,000	100	5%	Do. 5% Deb. . .	100	102 — 104
207,930	10	5/-	Western Telegraph Co., Ltd. . .	10	13½ — 13½
£75,000	100	5%	Do. 5% Debs., 2nd Series, 1906	100	101 — 104
518,945	Stk	4%	Do. 4% Deb. Stock, Red. . .	100	101 — 104

VI.—SHIPPING COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
32,500	10	5/6	Anchor Line (Henderson Bros.), Ltd., 5½ Cum. Pref.	10	84 — 84
£825,000	Stk	4½%	Do. 4½ Red. 1st Mort. Deb. Stk.	100	97 — 99
£672,900	Stk	4½%	British & African Ste. Nav. (1900) Ltd., 4½ 1st Mort. Deb. Stk. Red.	100	93 — 95
40,000	10	5/6	Bucknall Steamship Lines, Ltd., 5½ Cum. Pref.	10	6 — 7
£600,000	Stk	4½%	Do. 4½ 1st Mort. Deb. Stk.	100	75 — 78
£750,000	Stk	4½%	Clan Line Steamers, Ltd., 4½ Deb. Stk. Red. . .	100	98 — 100
60,000	20	16/-	Cunard Steam Ship Co., Ltd., Nos. 1-60,000. . .	20	13 — 13½
40,000	20	8/-	Do. Nos. 60,001-100,000.	20	6 — 7
£464,430	Stk	4½%	Elder Dempster Shipping, Ltd., 4½ 1st Mort. Deb. Stk. . .	100	98 — 100
1,200,000	1	6d.	Furness, Withy & Co., Ltd., Ord. . .	1	1 — 1½
30,000	10	5/-	Do. 5% Cum. Pref. . .	10	9½ — 10
327,300	100	4½%	Do. 4½ 1st Mort. Debs. Red.	100	105 — 107
25,328	7½	4/7	Gen. Steam Navigation Co., Ltd., Ord.	7½	4 — 4½
36,758	8	4/9½	Do. Non-Cum. 6% Pref. . .	8	62 — 7½
£150,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	96 — 98
55,000	5	1/3	Houlder Line, Ltd., Ord. . .	5	3 — 3½
40,000	5	2/9	Do. 5½ Cum. Pref. . .	5	3½ — 4
£200,000	Stk	4½%	Do. 4½ 1st Mt. Deb. Stk. Red.	100	85 — 88
141,500	10	5/-	Leyland (Fredk.), & Co. (1900), Ltd., 5% Cum. Pref. . .	10	3½ — 4
£1,160,000	Stk	5%	Peninsular and Oriental Steam Nav. Co., 5% Cum. Pref. . .	100	127 — 130
£1,160,000	Stk	7%	Do. do. Deferred . .	100	212 — 215
£800,000	Stk	3½%	Do. do. 3½ Deb. Stock. . .	100	99 — 101
£648,100	Stk	3½%	Do. do. 3½ 2nd Deb. Stk. . .	100	96 — 98
15,000	100	30/-	Royal Mail Steam Packet Co. Ord.	60	17 — 19
39,075	5	2/6	Shaw, Savill & Albion, Ltd., 6% Cum. "A" Pref. . .	5	42 — 5½
39,075	5	2/6	Do. "B" Ord. . .	5	4 — 4½
141,841	10	4/-	Union Castle Mail Steamship Co., Ltd., Ord. . .	10	8½ — 8½
24,000	10	4/6	Do. 4½ Cum. Pref. . .	10	9½ — 10½
£1,008,894	Stk	4%	Do. 4% Debenture Stk., Red.	100	100 — 102

VII.—MISCELLANEOUS COMPANIES.

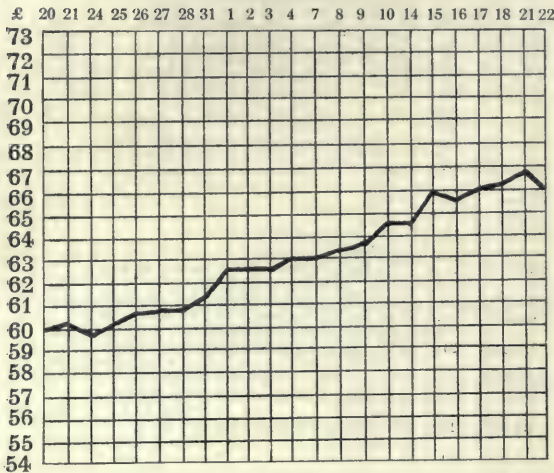
Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
60,000	1	9½d.	Chadburn's (Ship/Tele. Ltd., Ord. . .	1	7 — 1½
£750,000	Stk	5%	General Hydraulic Power Co., Ltd.	100	135 — 140
12,500	10	10/-	Oakey (John) and Sons, Ltd., Ord. . .	10	24 — 26
10,000	10	6/-	Do. do. 6% Cum. Pf.	10	14 — 15
183,588	1	7½d.	Power Gas Corp., Ltd., Ord., Nos. 66,463-260	15/-	1½ — 1½
66,462	1	1/-	Do. do. Nos. 166,462	1	1½ — 1½
282,524	10	7/-	United Alkali Co., Ltd., 7% Cm. P.	10	8 — 8
£2,691,560	Stk	5%	Do. 5% Mort. Deb. Stk., Red.	100	101 — 103
135,000	1	1/3½	Waygood (R.) & Co., Ltd., Ord. . .	1	1½ — 1½
135,000	1	7½d.	Do. 6% Cum. Pref. . .	1	1½ — 1½
33,500	5	2/6	Webley & Scott Revolver & Arms Co., Ltd. . .	5	3 — 3
33,500	5	2/3	Do. 5% Cum. Pref. . .	5	2½ — 2½
743,975	1	7½d.	Welsbach Incandescent Gas Light Co., Ltd., Ord. . .	1	1½ — 1½
600,000	1	9.09d.	Do. 6% Cum. Pref. . .	1	1½ — 1½
£82,211	Stk	5½%	Do. 5½ Deb. Stk. Red. . .	100	99 — 101

Stocks and Shares marked * are quoted ex-dividend

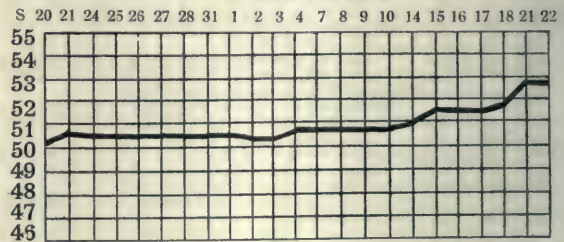
THE HOME METAL MARKET.

Showing Daily Fluctuations from October 19th to November 22nd.

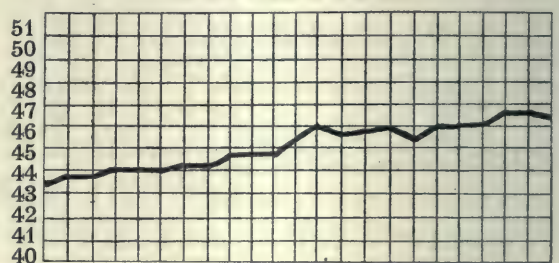
COPPER.



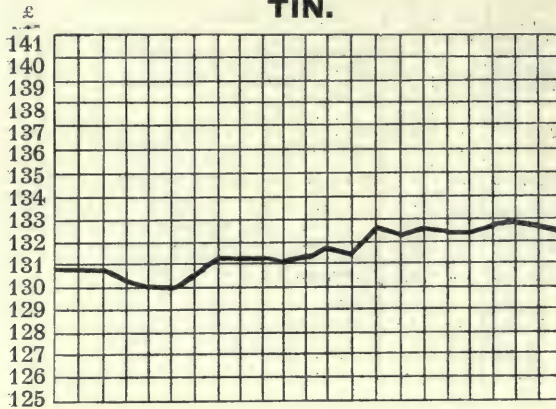
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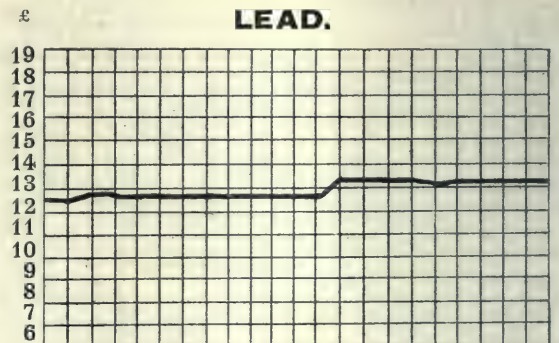
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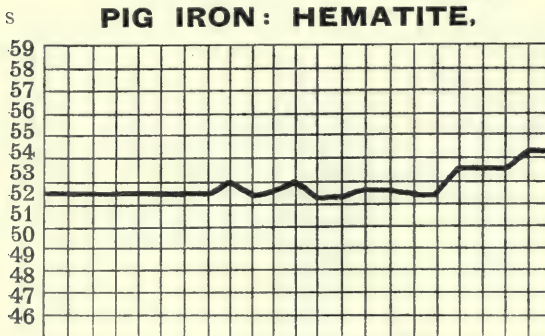
TIN.



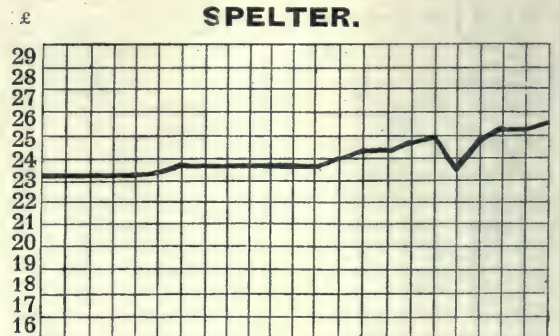
LEAD.



PIG IRON: HEMATITE.



SPELTER.



PRICES CURRENT OF COAL, IRON, STEEL, AND OTHER METALS.

MANUFACTURERS' AND MERCHANTS' QUOTATIONS.

MARKET REPORT.

Wednesday, November 23rd, 1904.

THE main interest in the metal market is still centred on copper, which has experienced another week of activity and excitement, not only in the speculative markets, but in almost all branches of the trade. Merton and Co.'s report points out accurately enough that the higher range of values now ruling, far from having checked demand, appears to have acted as a stimulus to buyers, and that the market is threatened with a possible shortage of supply.

The demand from the East, notably China, for ingot Copper for delivery well into next year, continues on a very large scale, but the heaviest buying of all is still to be found amongst consumers in the United States. The situation there is reported as extremely strong. The prices of manufactured copper, yellow metal, brass tubes, and all kindred products have considerably advanced. Sulphate of copper has also played a large part in the activity of the past week.

The iron and steel market, as was predicted in this column last week, exhibits more strength, and prices show a further substantial advance. Speculators would do well, however, to note the increase in the visible supply. Pig iron has again advanced, and there has been a large speculative business in Cleveland Warrants.

Spelter has had a sharp rise of over £1, dealers being caught short. It would appear that supplies are sold right out for months to come.

Lead is rather quieter, and prices have given way slightly on a few speculative sales. A recovery in quotations is looked for. Antimony keeps firm and quicksilver steady.

With copper absorbing so much attention, it is only natural that tin should have been more or less neglected. There is, however, a firm undertone to this section, and during the last day or two, buying on American account has caused quotations to harden, so that notwithstanding somewhat free selling from the East the outlook is for higher prices.

In the coal market the position is slightly more encouraging. Anthracite descriptions show an upward tendency, but generally, prices remain about the same, although for forward delivery the market is rather firmer.

IRON, STEEL, PIG- IRON, &c.

SCOTLAND.

Messrs. David Colville and Sons, Ltd., Dalzell Steel and Iron Works, Motherwell, N.B., quote as follows. Prices delivered in Glasgow or equal :—

Steel :	£	s.	d.
Siemens' Steel Plates, Marine Boiler Quality	6	15	0
" " " Land " "	6	17	6
" " " Ship Quality Plates	5	12	6
Siemens' Steel Bars, Boiler Quality	6	10	0
" " " Ship " "	6	0	0
" " " Angles	5	0	0

Manufactured Iron :

Bars—Dalzell	5	15	6
" Best	6	5	6
" Horseshoe	6	5	6
" Angle	5	17	6
" Best Angle	6	7	6
" Best Best	6	17	6
" Extra Best	7	7	6

Usual terms and extras. Special rates for delivery in England and export. The above prices subject to alteration without notice.

The Glasgow Iron and Steel Co., Ltd., Wishaw, quote as under (prices are delivered Glasgow or equal) :—

	£	s.	d.	
Steel Angles (Glasgow Crown Steel)	5	10	0	per ton.
Steel Ship Plates (Glasgow Crown Steel)	5	12	6	"
Steel Bars, Ship Quality (Glasgow Crown Steel)	6	5	0	"
Steel Bars, Boiler Quality (Glasgow Crown Steel)	6	15	0	"
Steel Land Boiler Plates (Glasgow Crown Steel)	6	5	0	"
Steel Marine Boiler Plates (Glasgow Crown Steel)	6	5	0	"

Less 5 per cent. discount. Extras as per standard list.

Special prices for delivery in England and for export. The above prices subject to alteration without notice.

John Spencer (Coatbridge), Ltd., Phoenix Ironworks, Coatbridge, N.B., quotes :—

Bars—Phoenix	£	s.	d.
Best	6	0	0
Best Best	6	10	0
Extra Best	7	0	0
Best Horse Shoe	7	10	0
Extra B.H.S.	6	10	0
Extra Best Cable	7	10	0
Rivet	8	0	0
Best Scrap Rivet	6	0	0
	7	0	0

	£	s.	d.
Angles—Phoenix	6	0	0
" Best	6	10	0
" Extra Best	7	0	0

Gas Tube Hoops—Phoenix Best	6	10	0
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	£	s.	d.
Plates—Phoenix	—		
" Best Boiler	7	5	0
" Best Best Boiler	7	15	0
" Extra Best Boiler	8	15	0

Boiler Tube Strips—Phoenix Best Best	7	15	0
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All per ton, delivered f.a.s., Glasgow, Greenock, Grangemouth, Granton, Leith, or Ardrossan. 5 per cent. discount cash monthly.

Messrs. R. Feldtmann and Co., of Glasgow, quote (Commission extra).

Pig Iron :	No. 1.	No. 3.
	£ s. d.	£ s. d.
Coltness, f.a.s. Glasgow.....	3 3 6	2 13 0
Gartsherrie..... "	2 16 0	2 11 0
Summerlee..... "	2 17 0	2 11 0
Carnbroe..... "	2 12 6	2 9 6
Langloan..... "	3 4 0	2 14 0
Calder..... "	2 18 0	
Clyde..... "	2 16 0	2 10 6
Glengarnock, f.o.b. Ardrossan.....	2 17 0	2 11 0
Eglinton..... "	2 11 3	2 9 0
Dalmellington, " Ayr.....	2 11 9	2 9 9
Shotts..... " Leith.....	2 17 6	2 11 6

NORTH OF ENGLAND.

Messrs. W. Whitwell and Co., Ltd., Thornaby Ironworks, Stockton, quote as follows, at works:—

	£	s.	d.
W.W. Crown Bars	6	7	6
W.W. Best Bars	6	17	6
W.W. Best Best	7	7	6
W.W. Best Best Best	7	17	6
W.W. Best Shoe	6	17	6
Thornaby Crown.....	7	17	6
Thornaby Best.....	8	7	6
Thornaby Best Best	9	7	6
Whitwell Special Admiralty Cable	10	0	0
Special Chain Iron	9	0	0
Tube and Nail Strips	6	10	0
W.W. Crown Angle Iron.....	6	10	0
W.W. Best Angle Iron	7	0	0
Tee Iron, to 8-inches United.....	7	7	6

Terms, Cash, less 2½ per cent. discount on 10th of month following delivery.

LANCASHIRE.

The Pearson and Knowles Coal and Iron Company, Ltd. Dallam and Bewsey Forges, Warrington, quote:—

	Iron.	Steel.
	£ s. d.	£ s. d.
Crown (BNF) Bars	6 10 0	7 0 0
" Angles	7 0 0	7 10 0
" Tees	7 10 0	8 0 0
" (WIW) Hoops	7 0 0	7 10 0
" Sheets	7 10 0	8 0 0

Ordinary Sizes, F.A.S. Liverpool in 10-ton Lots.

Extras for Sizes and Cutting as per List.

Lots under 5 cwt. of a Size 10/- per ton extra.

WORCESTERSHIRE.

Baldwins Ltd. (with which is amalgamated Knight and Crowther, Ltd.), Wilden Works, near Stourport, quote:—

	Singles 20 G 96in. by 36in. per ton.	Doubles 21 G to 24 G 96in. by 36in. per ton.
	£ s. d.	£ s. d.
Black Sheets :		
" Vale"	10 0 0	11 0 0
" Shield"	10 10 0	11 10 0
" Severn"	11 10 0	12 10 0
" Baldwin Wilden B."	12 10 0	13 10 0
Charcoal.....	16 10 0	17 10 0
Best Charcoal.....	18 10 0	19 10 0

Best CR and CA Sheets, 24 G, £10 10s. 0d. per ton.

Pickled cold-rolled and close annealed sheets specially quoted for.

Extra widths, Singles to 66in., Doubles to 56in., Lattens to 46in. Extra lengths, Singles to 168in., Doubles to 132in., Lattens to 108in.

	Singles 20 G to 108 by 36in. per ton.	Doubles 21 to 24 G to 96 by 36in. per ton.
	£ s. d.	£ s. d.
Tinned Sheets :		
Best Coke (Finish)	28 0 0	29 10 0
" Charcoal (Finish)	30 0 0	31 10 0
Extra " "	32 0 0	33 10 0

Cotton Can Tin Sheets to 39in. by 36in. specially quoted for.

Tin Plates, "Cookley," Best Charcoal, £1 7s. 0d. per box.

Patent Coated Sheets :

	£ s. d.	£ s. d.
No. 3 Lead.....	13 10 0	14 10 0
S.V. Lead	15 0 0	16 0 0
No. 3 Terne ..	15 0 0	16 0
S.V. Terne.....	16 10 0	17 10

Extreme sizes in Tin and Patent Coated specially quoted for.

Lattens up to 36 wide by 27 W.G. £1 10s. 0d. per ton extra throughout for all brands.

At works less 2½% for cash monthly, 10th inst.

Galvanized Corrugated Sheets :

	£ s. d.
"Phoenix" Brand, 24 G., f.o.b. London, in Bundles	11 10 0 per ton.
"Blackwall" Brand, 26 G., in felt-lined cases for Australia, f.o.b. London.....	14 0 0 "

Galvanized Working Up-Sheets :

	£ s. d.
24 G., f.o.b. London, in Bundles	13 10 0 per ton.

WALES.

Cordes (Dos Works), Ltd., of Newport, Mon., quote "Star" brand patent wrought nails, steel nails, &c.

Discounts—

45 per cent. off 1-inch to 3-inch strong rose and all fine rose and 6dy. and 8dy. pound.

40 per cent. off 3½-inch to 7-inch strong rose and 10dy. and 20dy. pound.

40 per cent. off all sharp-pointed nails.

Delivered in lots of 2 cwt. and upwards. Extra 2½ per cent. discount off the gross on two tons and upwards.

Steel rose, flat points, 5-inch to 7-inch basis:—

2 tons 9/3 per cwt. } d/d any Railway Station.
Under 2 tons 9/6 per cwt. }

Steel cut nails, 3-inch basis—

2 tons 8/- per cwt. } d/d any Railway Station.
Under 2 tons 8/3 per cwt. }

Slit rods (iron) £7 10s. per ton, at works for 2-ton lots.

Messrs. Richard Thomas and Co., Ltd., of 3, Love Lane, Eastcheap, E. C. — Works: South Wales, Burry, Lydney, Lydbrook, and Cwmbwrla, quote:—

	Per Box.
	f.o.b. Wales.
Coke Tin-plates.	£ s. d.
C 18½ by 14 124s. 110 lb. "BV"	0 12 9
C 20 by 10 225s. 155 " "Jumbo"	0 18 0
C 20 by 14 112s. 108 " "Lydbrook"	0 12 3
C 28 by 20 112s. 216 " "Lydbrook"	1 4 9

Charcoal Tinplates:

C 20 by 14 112s. 108 lb. "Allaway"	0 12 9
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BELGIUM.

C. L. Faulkner, Suffolk House, Laurence Pountney Hill, London, E.C., quotes:—

Prices quoted are in £ stg. and per ton of 1,015 kos. (2,240 lb.) delivered free on board ANTWERP for approved quantities.

Steel:	£	s.	d.
Basic Bars	at 4	15	0 per ton.
" Angles	at 4	16	0 "
" Tees	at 4	19	0 "
" Joists	at 4	7	6 "
Billets	at 3	14	0 "
Sheet Bars	at 3	16	0 "
Heavy Rails	at 4	0	0 "
Light Rails	at 4	16	0 "

Finished Steel:

Fencing Standards	at 4	19	0 per ton.
Shoeing Bars	at 5	2	6 "
Tyre Bars	at 5	4	0 "
Half-Round Bars	at 5	2	6 "

Structural Steelwork. Prices on application.

METALS.

Messrs. French and Smith, 147, Leadenhall Street, and 11, Oldhall Street, Liverpool, quote:—

TIN.

Tin:	£	s.	d.	£	s.	d.
English f.o.b. Ingots						
Dis. 1¼%	133	10	0 to 134	0	0	0 per ton.
London or Liverpool Bars						
—4 cwt. Barrels						
Dis. 1¼%	134	10	0 to 135	0	0	0 "
Straits Warehouse net						
cash	132	10	0 to 132	12	6	0 "
London 3 months fixed	132	5	0 to 132	7	6	0 "
Warehouse, London:—						
Australian net cash	132	10	0 to 133	10	0	0 "
Banca " "	133	0	0 to 133	10	0	0 "
Billiton " "	132	15	0 to 133	0	0	0 "

COPPER.

Copper:	£	s.	d.	£	s.	d.
Ore	0	11	9 to 0	12	9	per unit.
Regulus, Matte and Precipitate	0	13	0 to 0	13	6	0 "
Chili Bars G.M.B. Cash 2½%	66	0	0 to 66	10	0	0 per ton
Swansea, Liverpool, or London						
3 months fixed	66	7	6 to 66	12	6	0 "
Australian in Warehouse,						
London, P. C. C. Burra						Nominal.
Cake, Wallaroo Cake						
Other Brands 2½%	68	0	0 to 69	10	0	0 "
English f.o.b.						
Tough Cake 2½%	69	0	0 to 69	10	0	0 "
" Ingots	69	0	0 to 69	10	0	0 "
Best Selected 2½%	70	0	0 to 71	0	0	0 "
Sheets, Sheathing and						
Rods 2½%	80	0	0 to 81	0	0	0 "
Sheets, 4 by 4 feet for						
India 2½%	77	0	0 to 78	0	0	0 "

YELLOW METAL.

Yellow Metal:

	£	s.	d.	£	s.	d.
Sheets, 4 by 4 feet for						
India 2½%	0	0	6½	—	—	— lb.
f.o.b. Sheathing 2½%	0	0	6½	—	—	0 "

SPELTER.

	£	s.	d.	£	s.	d.
Silesian, Net cash at out-						
ports	25	5	0 to 25	10	0	0 per ton.
Special Silesian, at out-						
ports	25	15	0 to 26	0	0	0 "
British, Net cash at London	25	0	0 to 26	0	0	0 "
Blende of 50 %	6	6	6			0 "
Calamine	6	10	0			0 "

LEAD.

	£	s.	d.	£	s.	d.
English Pig, 2½%, at						
works, London, Liverpool						
or Swansea	13	5	0 to 13	7	6	0 per ton.
Spanish, 2½%, ex ship,						
Bristol, Liverpool, New-						
castle, Swansea, etc.	13	0	0 to 13	2	6	0 "
Lead Ore of 70 %	6	15	0			0 "

ANTIMONY.

	£	s.	d.	£	s.	d.
Star Regulus	37	0	0 to 38	0	0	0 per ton.
Ore (50 % good quality and						
produce)	8	10	0 to 9	0	0	0 "
Crude						Nominal. "

QUICKSILVER.

	£	s.	d.
Spanish, per flask containing 75 lb			7 15 0
Italian " " " "			7 14 0

COAL, LEICESTERSHIRE.

The Nailstone Colliery Company, Leicester, quote. Price per Ton at Pit of 20 Cwt., with ½ Cwt. per Ton for wastage:—

Upper Main Seam.	s. d.
Main Coal	8 0
Best Hard Steam (hand picked, as used by the	
Railway Companies)	7 0
Best Hard Steam Cobbles (made through 6 in. mesh,	
free from slack)	6 6
Main Slack	4 0
Terms, net cash on 10th of month following delivery.	

	£	s.	d.	
Acetate of Lime: Brown at Manchester net	8	10	0	per ton.
" " Grey	11	10	0	" "
Alumina : Alum, Lump, loose.....	5	5	0	" "
" " " in casks	5	7	6	" "
" " Ground, in bags	5	15	0	" "
Sulphate of Alumina, 14%	4	10	0	" "
Ammonia : Carbonate	0	0	3 ⁵ / ₈	per lb.
Muriate Grey f.o.b. Liverpool	23	10	0	per ton.
Sal-ammoniac, Lump, 1sts, del ^d . U.K.	42	0	0	" "
" " " 2nds, ...	40	0	0	" "
Sulphate f.o.b. Liverpool	12	17	6	" "
Arsenic : Best White Powdered net	12	5	0	" "
Bleaching Powder, 35%	4	2	6	" "
Borax : British Refined Crystal.....	12	0	0	" "
Coal Tar Products :				
Benzole, 50/90 %.....	0	0	7 ¹ / ₂	per gal.
" " 90%.....	0	0	9 ¹ / ₂	" "
Carbolic Acid Crystals, 34/35° C.	0	0	5 ¹ / ₂	per lb.
" " " 39/40° C.	0	0	6	" "
" " " Liquid, 97/99 % ...	0	0	9	per gal.
" " " Crude, 62 ¹ / ₂ % at 60° F.	f.o.b.	0	2	2
Creosote, ordinary good liquid.....	0	0	1 ⁵ / ₈	" "
Naphtha, Crude, 20 % at 120° C.	0	0	8	" "
" " Solvent, 90% at 160° C.f.o.b.	0	0	8	" "
" " " 95 % at 160° C. " "	0	0	9	" "
" " " 90 % at 190° C. " "	0	0	10 ¹ / ₂	" "
" " Rectified, flash point over 73° F. f.o.b.	0	0	10 ¹ / ₂	" "
" " Rectified, flash point over 100° F. f.o.b.	0	0	10 ¹ / ₂	" "
Naphthalene, all qualities.				
Pitch.....f.a.s. Manchester.	1	13	0	per ton.
Copperas : Green, in bulk	0	12	6	" "
" " barrels f.o.b. L'pool	2	0	0	" "
" " Cake	1	2	6	" "
Copper : Sulphate.....	21	5	0	" "
Cyanides : 98% minimum f.o.b. net	0	0	7 ¹ / ₂	per lb.
Lead : Acetate (Sugar) White, English.....	27	10	0	per ton.
" " " Foreign c.i.f.U.K.	23	10	0	" "
" " " Grey	21	0	0	" "
" " " Brown at Manchester	15	10	0	" "
Nitrate.....	22	10	0	" "
Litharge, Flake	15	0	0	" "
" " Powder	15	10	0	" "
Red Lead, Genuine, c.i.f. London less 5%	15	10	0	" "
White " " Dry " " "	16	15	0	" "
Naphtha (Wood) : Miscible, 60 o.p.....	0	2	10	per gal.
" " Solvent.....	0	2	7	" "
Potash : Bichromate... delivered England...	0	0	3	per lb.
Carbonate, 90/92 % ... c.i.f Hull ...	18	0	0	per ton.
Caustic, 75/80 %	20	0	0	" "
Chlorate.....net	0	0	3 ¹ / ₁₆	per lb.
Montreal.....in Store, Liverpool	35	0	0	per ton.
Prussiate, Yellow net	0	0	4 ¹ / ₈	per lb.
Soda : Ash, Caustic, 48 %, Ordinary ... ,	5	5	0	per ton.
" " " Refined.....	6	5	0	" "
" " Carbonated, 48 %	5	10	0	" "
" " " 58 % (Ammonia Alkali) net	4	10	0	" "
" " Bleachers' Refined Caustic 50/52 % net	6	10	0	" "
Caustic, White, 77 %.....	10	10	0	" "
" " " 70 %	9	12	6	" "
" " " 60 %	8	12	6	" "
" " Cream, 60 %	8	10	0	" "
Crystals, in bags	3	0	0	" "
" " barrels	3	7	6	" "
Acetate c.i.f. Hull net	16	10	0	" "
Bicarbonat e, in 1 cwt. kegs.....	6	15	0	" "
Bichromate.....delivered England....	0	0	2 ¹ / ₂	per lb.
Chlorate.....net	0	0	3 ¹ / ₁₆	per lb.
Nitrate...ex quay Liverpool, ... ,	10	12	6	per ton.
Phosphate	9	5	0	" "
Prussiate	0	0	3 ⁵ / ₈	per lb.

Soda : Silicate, Solution, 140° Tw.	£	s.	d.	
Sulphate (Glauber Salts)	4	10	0	per ton.
" (Salteake, 95%)	1	12	6	"
Sulphur : Recovered	1	15	0	"
Roll	4	15	0	"
Flowers	6	15	0	"
Zinc : Sulphate	7	10	0	"
	6	15	0	"

MINERALS.

Barytes : Lump Carbonate, 90/92%	£	s.	d.	
Sulphate, No. 1, White	3	10	0	"
China Clay : of various qualities for all purposes; prices from about 11/- to about 30/- per ton, f.o.b. Cornwall: stocks also kept at Runcorn and Preston. Quotations given carriage paid.	2	15	0	"
Chrome Ore : Basis 50% c.i.f. British Ports	3	7	6	"
Manganese : Lump c.i.f. Liverpool 10½d. per metallic unit.	2	5	0	per ton.
Ochre : French JC	5	10	0	"
" "	3	10	0	"
Talc : (French Chalk)	3	10	0	"

OILS, etc.

Aniline Oil	£	s.	d.	
" Salt	0	0	4½	per lb.
Castor Oil : French, 1st pressure, f.o.b. Marseilles less 1¼%	0	0	4½	"
English, 1st pressure, f.o.r. Hull, less 2¼%	20	0	0	per ton.
Cocoa Nut Oil : Ceylon, ex store Manchester	19	15	0	"
Cochin, ex store Manchester	31	10	0	"
Cotton Seed Oil : Refined at Hull, less 2¼% naked	33	0	0	"
Edible	15	0	0	"
2½% naked	15	10	0	"
Glycerine : Crude, 80%	31	0	0	"
Linseed Oil : Raw	13	10	0	"
naked	14	10	0	"
Boiled	14	10	0	"
Starch : American Pearl	8	15	0	"
Dextrine	17	10	0	"
Farina	15	10	0	"
Turpentine : American	39	15	0	"
Russian	20	0	0	"

TIMBER.

Messrs. Alfred Dobell and Co., Liverpool, quote:—

COLONIAL WOODS.**Timber.**

Quebec Square White Pine... per cub. ft.	£	s.	d.	£	s.	d.
Quebec Waney Board Pine...	0	1	9	to	0	3
St. John Pine, 18 in. average	0	2	8	0	3	9
Lower Ports Pine	0	2	3	0	3	3
Quebec Red Pine	0	1	1	0	1	6
Quebec Oak, 1st quality	0	1	6	0	1	10
Quebec Oak, 2nd quality ...	0	2	9	0	3	3
Ash	0	1	6	0	2	6
Elm	0	1	6	0	2	3
Hickory	0	3	0	0	3	6
Quebec Birch	0	2	0	0	2	6
St. John Birch	0	1	6	0	2	3
Birch Planks	0	1	6	0	2	0
Spruce Spars	0	0	9	0	0	11
	0	0	10	0	1	0

Deals.

1st quality Quebec Pine	£	s.	d.	£	s.	d.
2nd do.	22	10	0	to	32	10
3rd do.	17	0	0	22	10	0
St. John, N.B., etc., Spruce	11	10	0	13	0	0
Lower Ports Spruce	6	10	0	6	15	0
	6	0	0	6	10	0
Spruce Boards	5	10	0	6	0	0
Lathwood	per fathom	3	12	6	4	0

UNITED STATES, etc., WOODS.**Pitch Pine.**

Hewn	£	s.	d.	£	s.	d.
Sawn	per cub. ft.	0	1	3	to	0
Planks, Stowage	0	1	8	0	1	8
Boards, Prime	0	0	10	0	1	6
	0	0	10	0	1	0
	per std.	12	10	0	16	0
Oak Timber	per cub. ft.	0	1	6	0	2
Oak Planks	0	1	6	0	2	1
East India Teak	per load	12	0	0	15	0
Greenheart	6	15	0	7	10	0

EUROPEAN WOODS**Timber.**

Riga Redwood	£	s.	d.	£	s.	d.
Dantzic and Memel Fir, Crown	per cub. ft.	0	1	9	to	0
Dantzic and Memel Fir, Middling	0	2	1	0	2	6
Stettin	0	1	9	0	1	10
Swedish	0	1	9	0	1	11
Riga Whitewood	0	1	2	0	1	4
Norway Mining Timber	0	1	3	0	1	6
Dantzic and Stettin, etc., Oak	0	0	9	0	0	10
	0	2	6	0	3	0

Wainscot Logs.

Crown	£	s.	d.	£	s.	d.
Austrian	0	4	6	0	5	0
	0	4	0	0	4	6

Norway Spars	£	s.	d.	£	s.	d.
	0	1	2	0	1	9

Deals.

Red Archangel and Onega, 1st quality	per std.	19	0	0	20	0	0
Red Archangel and Onega, 2nd quality	„	16	0	0	17	10	0
Red Archangel and Onega, 3rd quality	„	12	10	0	15	0	0
St. Petersburg, 1st quality...	„	16	0	0	17	10	0
Do. 2nd „ ...	„	14	0	0	15	0	0
Gefle	„	14	0	0	17	10	0
Wyburg	„	12	10	0	14	0	0
Uleaborg	„	12	10	0	14	10	0
Gothenburg	„	14	0	0	17	10	0

Flooring Boards—Whitewood:

Mixed 1st and 2nd quality, planed (c.f.&i.)	per std.	8	5	0	8	15	0
3rd quality planed (c.f.&i.)...	„	7	10	0	7	15	0

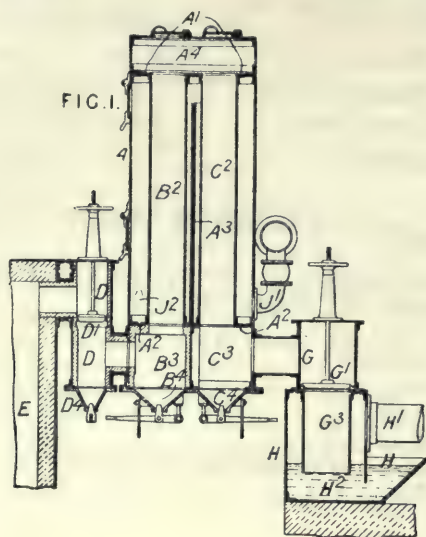
Lathwood:

St. Petersburg and Riga— 8 feet	per fm.	10	10	0	11	10	0
St. Petersburg and Riga— 4 feet	,,	5	5	0	5	10	0

SELECTED PATENTS.

GAS-PRODUCERS.

A. B. Duff, 5,310, Dahlia Street, Pittsburg, Pennsylvania, U.S.A. July 23rd.—In this invention hot gas from the producer *e* is utilised in the apparatus *a* for heating the air or air and steam blast, and afterwards passed through a washer *h*. The

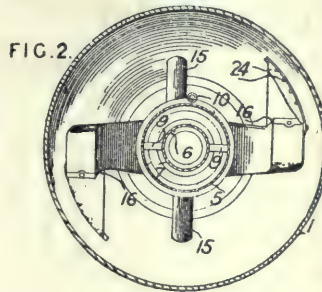
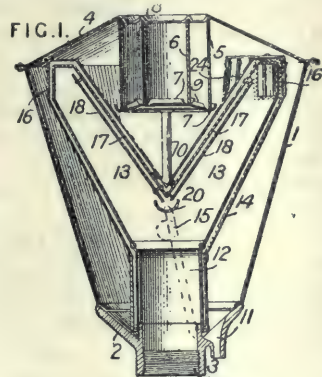


apparatus *a* comprises an outer cylindrical shell containing four tubes of large diameter, two only of which are shown at *b*², *c*². These tubes are arranged in pairs on each side of a central partition *a*³ extending upwards to within a short distance of the upper tube-plate *a*¹. Each pair open at their upper ends into a common chamber *a*⁴ above the tube-plate *a*¹, and at their lower ends into separate chambers *b*³, *c*³ connected with the producer *e* and washer *h* respectively. Air inlet and outlet connections *j*¹, *j*² are provided on opposite sides of the outer shell just above the lower tube-plate *a*², and dust-collecting boxes *b*⁴, *c*⁴, *d*⁴ are fitted to the chambers *b*³, *c*³, *d*³. The hot gas from the producer *e* passes through the chamber *d* into the chamber *b*³, and ascends through the tubes *b*² to the chamber *a*⁴. It then descends through the tubes *c*² to the chamber *c*³, and passes into the washer *h*, where it escapes under the serrated or perforated edge of the casing *g*³, and bubbles up through the water *h*², finally passing away through the gas-discharge pipe *h*¹. The air or air and steam to be heated enters the casing through the connection *j*¹, passes upwards

in contact with the tubes *c*² to top of the partition *a*³, and then downwards on the opposite side to the outlet *j*². Stop valves *d*¹, *g*¹ are fitted in the chambers *d*, *g* to regulate the flow of the gas.

STEAM SEPARATORS.

W. F. Warden, Akron, Ohio, U.S.A. July 22nd. (Date applied for under Patent Act, 1901, May 14th.)—In this invention water of condensation is separated from exhaust steam and collected, so as to allow dry steam to escape, by the device shown, which is secured to the exhaust pipe by a sleeve 3. The truncated conical casing 1 is secured to a water-collecting base 2 with an outlet 11 and has a conical top 4 carrying concentric outlet sleeves 5, 6. These sleeves have inclined flanges 8 at the top to prevent water from being blown out with the steam, and annular troughs 7 at the bottom connected by gutters 9 and having a discharge pipe 10 leading to the base. The steam pipe 12 has branches 13 surrounded by an air chamber 16 communicating with the exterior through trans

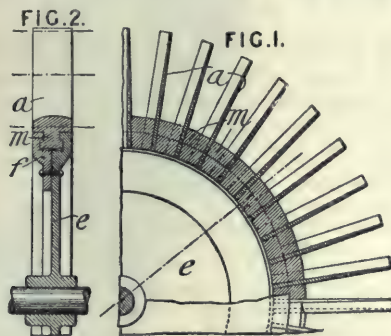


verse pipes 15 and having perforated walls at the discharge ends of the branches 13. Curved deflecting plates or hoods 24, with ribbed sides and flat tops, are

arranged at these discharge ends and have troughs at the bottom connected by pipes to the base. Below the longitudinally-corrugated upper walls 17 of the branches 13 are arranged longitudinally-corrugated plates 18 with perforations between the gutters. A collecting-trough 20 is connected by a pipe with the base.

STEAM, ETC., TURBINES.

E. W. Howarth, 46, Lincoln's Inn Fields, London.—(*Akt.-Ges. der Maschinenfabriken von Escher, Wyss, and Co. ; Zurich, Switzerland.*) July 24th.
—The blades *a* shown in figure of a steam or gas turbine

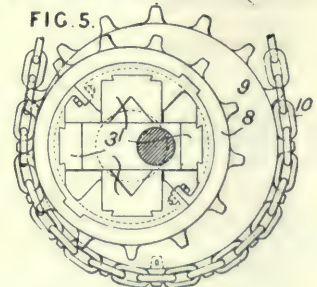
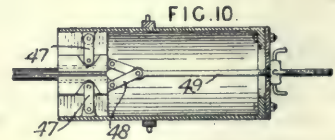
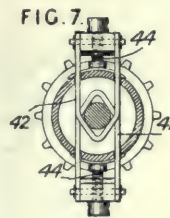
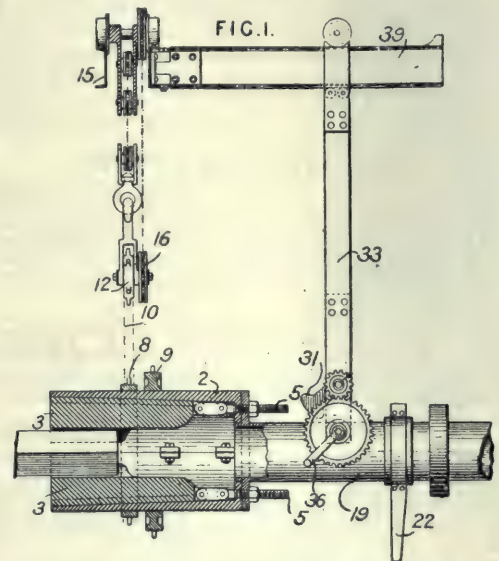


wheel have a rectangular outline and a crescent-shaped cross-section. The blades increase in thickness towards the wheel *e* and have T-shaped ends which engage in grooves formed in the rim of the wheel and in a ring *f* which is fastened to the rim. The hollow or channel in the blades is of uniform depth, and they are separated by spacing-pieces *m*.

FORGING METALS.

R. F. Devine, Ellwood City, Pennsylvania, U.S.A. July 25th.—This apparatus has been designed for manipulating forgings under a hammer, and comprises a tubular holder 2, with jaws 3, slung from a jib 15. On the holder are feathered one or more sprocket-wheels 8, 9, adjusted to balance the forging, when the whole is suspended by a chain 10 from a suitable hoisting-gear on the jib. The axle of the chain-wheel 12 carries a second chain-wheel 16, the chain of which is brought down with jib-post, so that the holder and work may be rotated by a winch handle. The wheel 9 is eccentrically mounted on the holder so that, by the aid of suitable jaws 3¹ (fig. 5), works with eccentric portions, such as crank shafts, may be held in a balanced position. In forgoing multiple-throw crank shafts, the shaft may be held between the anvil and the hammer while it is twisted by the

chain 10 to set the webs. The forging may be moved longitudinally by an endless chain (not shown), connected to a yoke 22 on an extension 19 of the holder, the chain being situated below the floor level and operated by a winch. The forging is tilted to enable it to pass the anvil, by pressing a cam 31 upon the extension 19. The cam is rotated by gearing and a handle 36, the whole being carried by a yoke bar 33, travelling on an auxiliary jib 39, pivoted to the jib 15. The jaws 3, shown in fig. 1, are drawn in along inclined seatings by screws 5 to grip the work, but jaws of any shape and operated by various means



may be employed. Fig. 7 shows pairs of yoke jaws 42 operated by screws 44, while fig. 10 shows jaws pivoted on links 47 and drawn in by links 48 and a screw 49,

NEW PUBLICATIONS.

"PRACTICAL COAL MINING."

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The fact that Mr. Andrew Jamieson's widely-known treatise has now reached its fourteenth edition speaks well for the reliable manner in which the author has accomplished the arduous task of combining perspicacity with technical accuracy. All engineering students seeking to qualify for the diplomas and degrees of technical colleges will profit by a knowledge of this new edition, in which the most recent types of pyrometers and calorimeters are dealt with, special attention being given to the fundamental principles of heat and thermodynamics. The latest forms of boilers, engines, and condensing plants for up-to-date electric light and power installations are depicted, and considerable space is devoted to discussing the most recent form of indicator, with numerous diagrams from simple compound, triple, and quadruple-expansion reciprocating engines. Two new lectures have been written upon the best steam turbines for land and marine purposes, with a mathematical explanation of their steam consumption.

BOOKS RECEIVED.

Electric Furnaces and their Industrial Applications. By J. Wright. With 57 illustrations: Constable and Co., Ltd. 8s. 6d.

Machine Drawing for students preparing for the Science Examinations in Technical Institutes and Evening Schools. By Alfred P. Hill. P. S. King and Son.

Carpentry Workshop Practice. By Charles F. Mitchell and George A. Mitchell. New and enlarged edition. With numerous illustrations. Cassell and Co. 1s. 6d.

The Commission of H.M.S. *Implacable*. Mediterranean Station, 1901-1904. By G. R. Parker, A.B. The Westminster Press. 4s. net.

NEW CATALOGUES.

Messrs. Crompton and Co., Ltd., of Salisbury House, London Wall, E.C., have just issued a new catalogue of Continuous Current Motors of standard design. Its value is greatly enhanced by the many diagrams and tables. The subject is very fully dealt with, and this catalogue cancels all previous issues.

The "Stolzenberg" Patent File Company, draw attention to their specialities by means of a monthly record edited by T. Kayser, No. 11 of Vol. I. of which is open before us. Among other things in this issue the "Stolzenberg" Reminder, Book Files for "Stolzenberg" Apparatus, and the "Stolzenberg" Improved Card Index, are briefly described and illustrated.

Messrs. Mather and Platt, Ltd., Salford Iron Works, Manchester, have issued a third edition of their catalogue and price list of Multipolar Dynamos, which we note cancels all previous lists.

We have received from the Crypto Electrical Company, of 3, Tyers Gateway, Bermondsey Street, S.E., a well-printed circular dealing with their new pattern alternating current induction and repulsion motors. An important feature of the former is that starting is accomplished by merely closing the switch and pressing the button, the usual start switches and resistances being dispensed with. In introducing their repulsion motor the Company point out that with pure repulsion motors there is an enormous drop in speed as the load comes on, rendering them more difficult of control and less efficient than series motors. The Crypto motor is so wound as to secure a greater output, a better power factor, and less tendency to race at light loads than a common repulsion motor.

Mr. Eric S. A. Smith, of Bridlington, sends us several leaflets describing Smith's Backus Water Motors which are made to drive any machinery. There are illustrations of the motor attached to a circular saw, a church organ, and driving printing machinery.

The Unbreakable Pulley and Mill Gearing Company, Ltd., have issued a second edition of "Some Notes on Various Methods of Power Transmission in Works and Factories," by W. E. Buck. A good deal of information is given, and the work should prove useful to manufacturers.

MEETINGS FOR THE ENSUING WEEK.

FRIDAY, NOV. 25.—North-East Coast Institution of Engineers and Shipbuilders meet at Westgate Road, Newcastle-on-Tyne, 7.30 p.m.—Physical Society of London: Meeting at the Finsbury Technical College, 5 p.m.

SATURDAY, NOV. 26.—Manchester Association of Engineers: Paper, "Engine Shaft Bearings," at the Grand Hotel, 7 p.m.—Glasgow Technical College Scientific Society: Paper by Mr. Maurice George on "The Electrical Drive of Large Reversing Engines Working Intermittently, 7.30 p.m.—Staffordshire Iron and Steel Institute: Paper by Mr. J. H. Hamilton, B.Sc., on "Gas Engines in Iron and Steel Works."

MONDAY, NOV. 28.—Society of Arts: Cantor Lecture by Mr. D. J. Blakley, 8 p.m.—Institution of Marine Engineers: Meeting at Romford Road, Stratford, 8 p.m.

TUESDAY, NOV. 29.—Institution of Civil Engineers: Ordinary Meeting at Great George Street, Westminster, 8 p.m.

WEDNESDAY, NOV. 30.—Anniversary Meeting of the Royal Society.—Society of Arts: Ordinary Meeting under the presidency of Sir Michael Hicks Beach, Bart., D.C.L., M.P.—Paper by Mr. Arthur Lee, M.P., on "The British Canals Problem."—Liverpool Engineering Society: Meeting at the Royal Institution, Liverpool—Paper by Mr. S. H. Ellis, A.M.Inst. C.E., "Some Notes on Hydraulic Lines."

THURSDAY, DEC. 1.—Meeting of the Royal Society, 4.30 p.m.—Institution of Civil and Mechanical Engineers, Ordinary Meeting at 8 p.m.—The Chemical Society meets at Burlington House, Piccadilly, 8 p.m.—Institution of Electricians Engineers: Annual Dinner, Hotel Cecil, 7 p.m.

FRIDAY, DEC. 2.—Junior Institution of Engineers meets at 8 p.m.

PAGE'S WEEKLY

Miscellaneous

MAIN SWITCHES

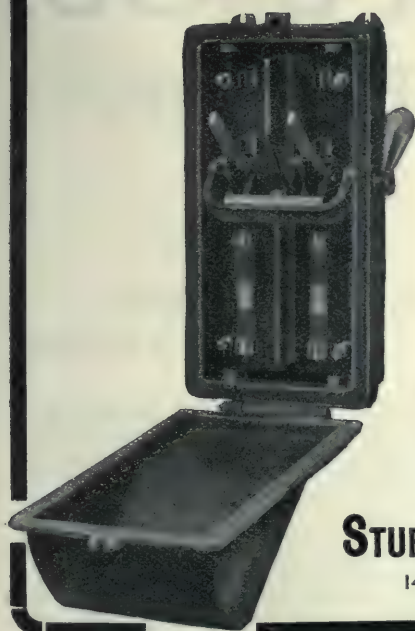
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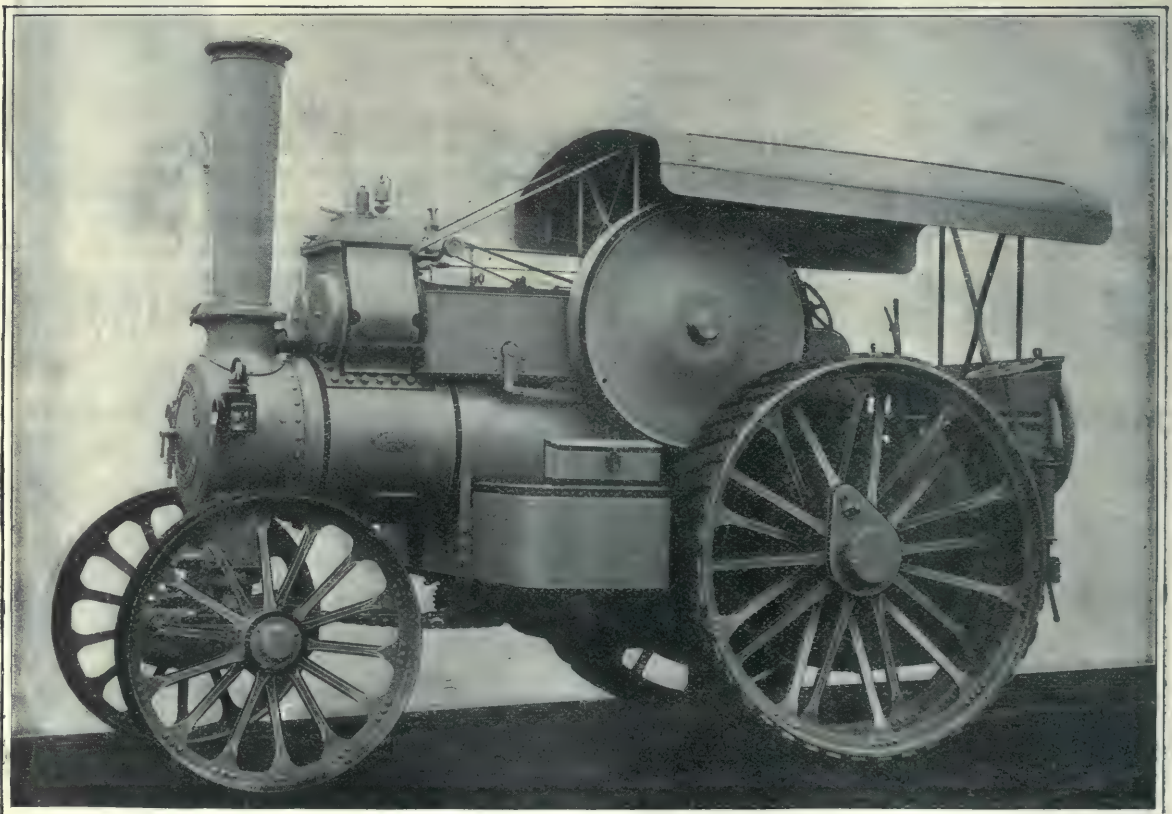


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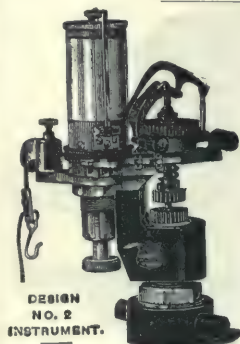
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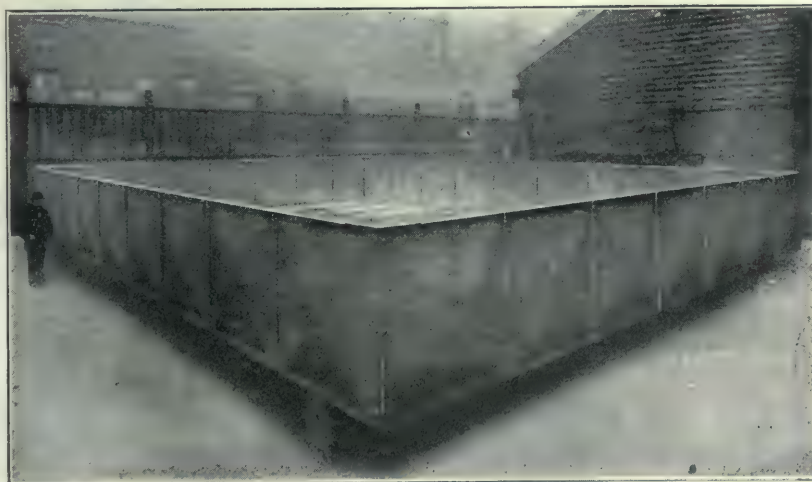
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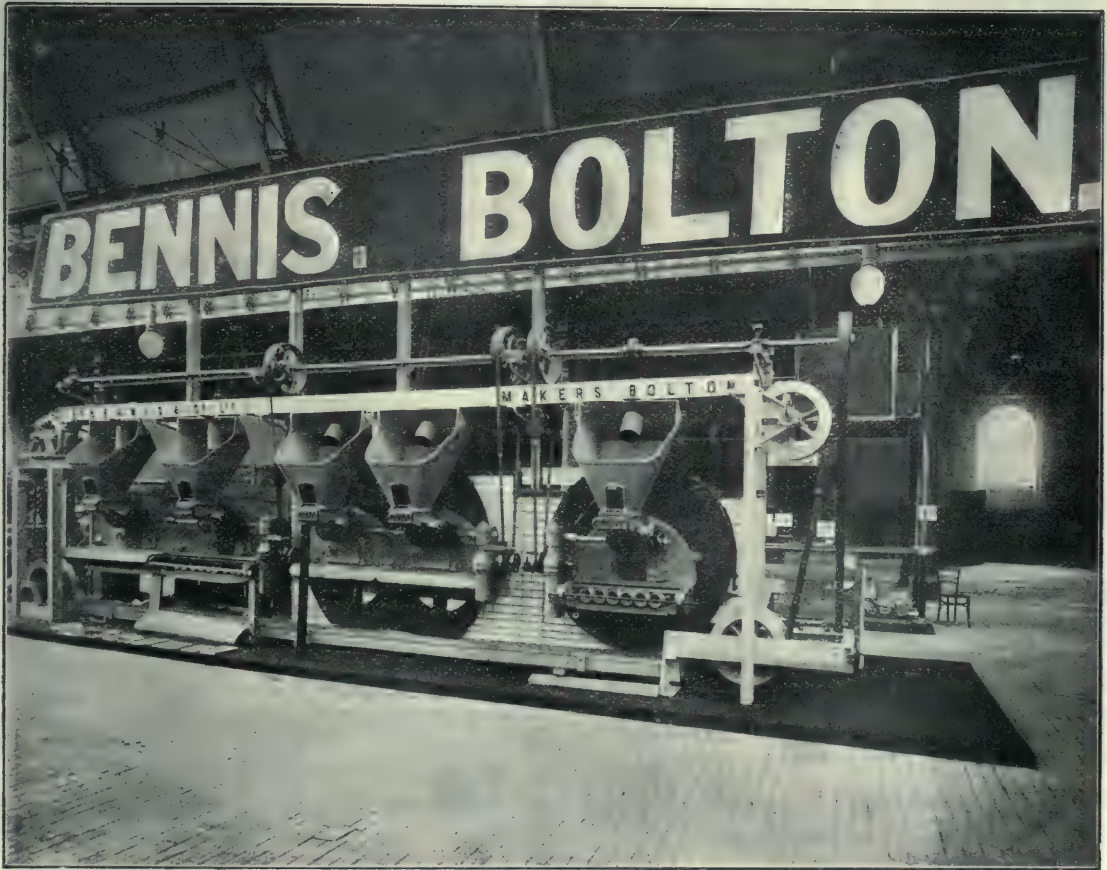
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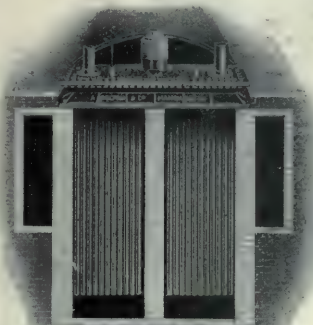
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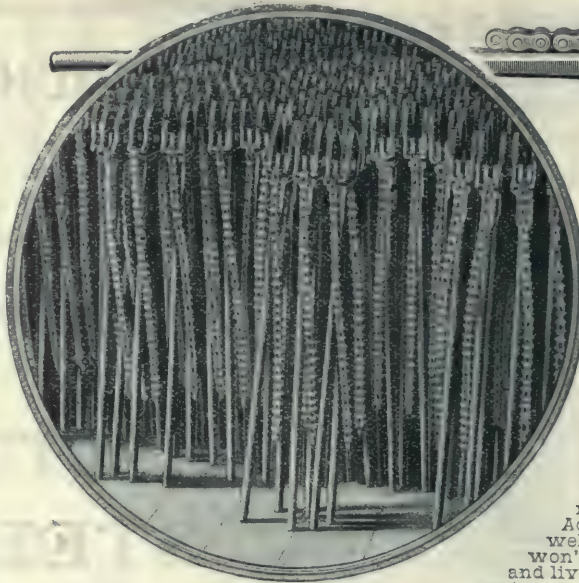
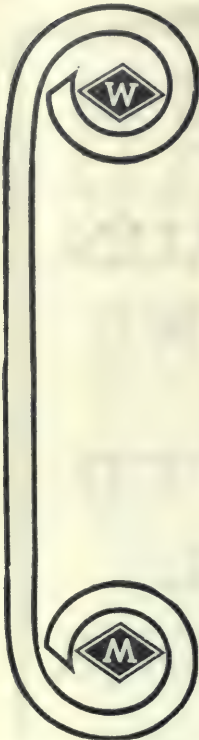
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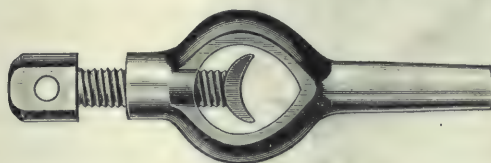
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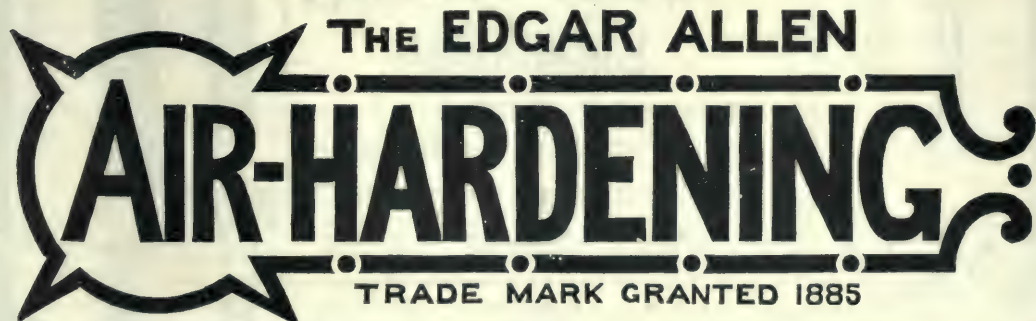
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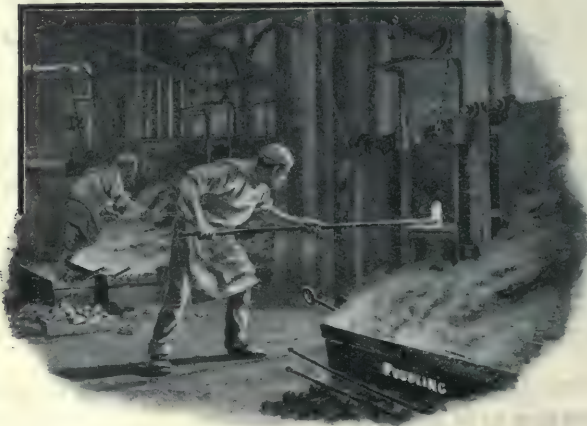
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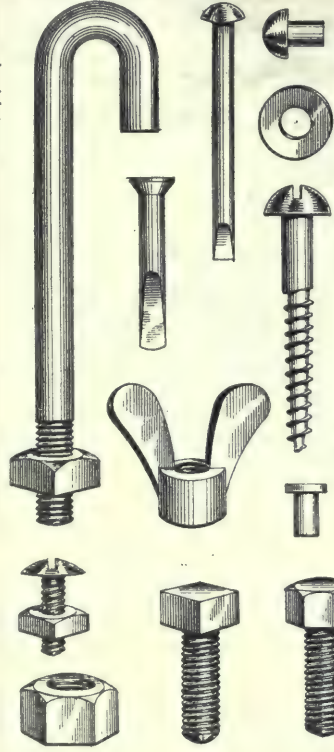


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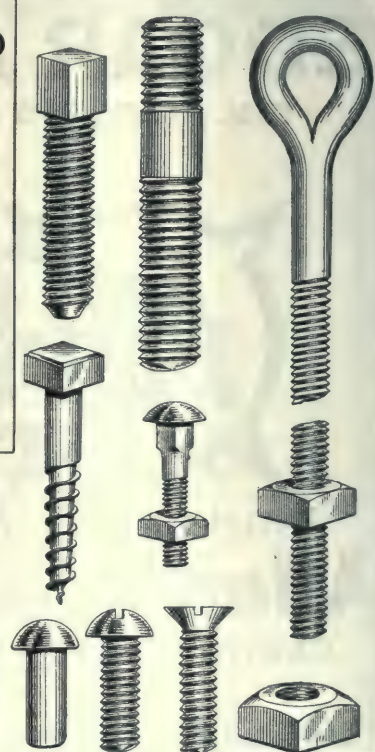
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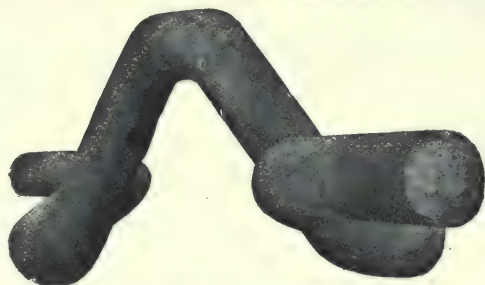
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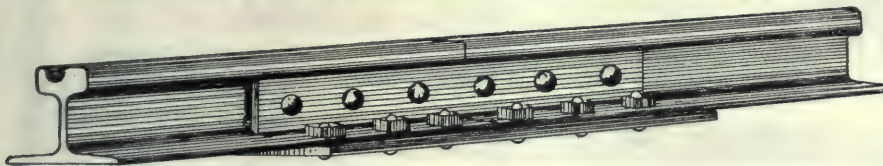
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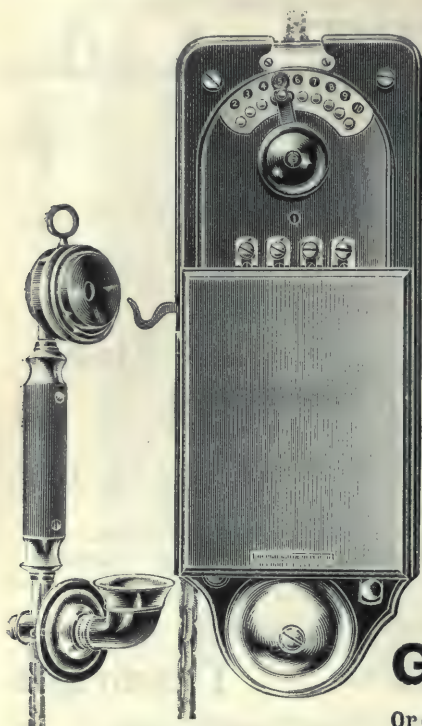
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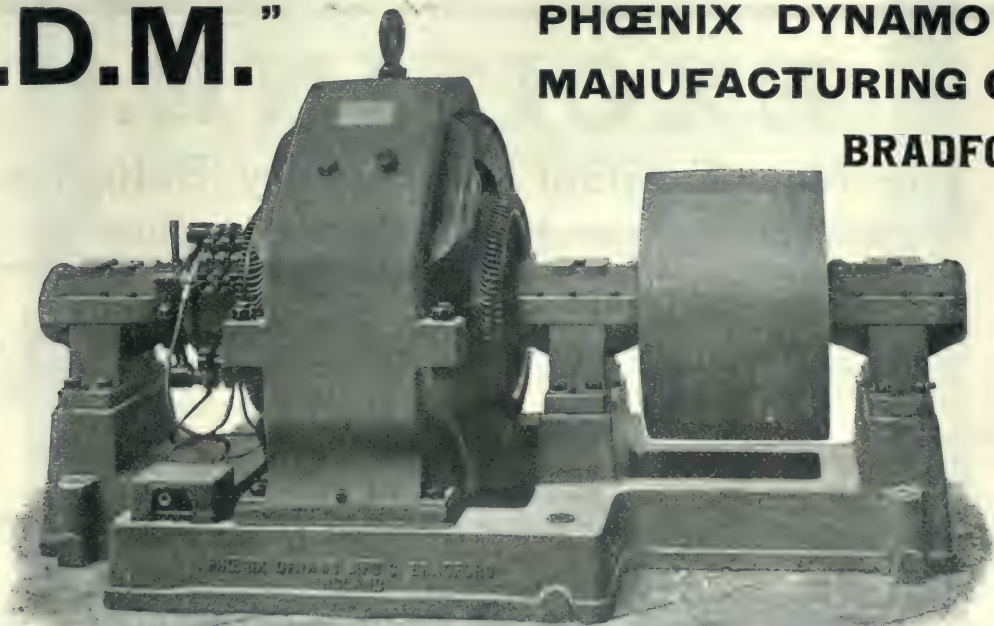
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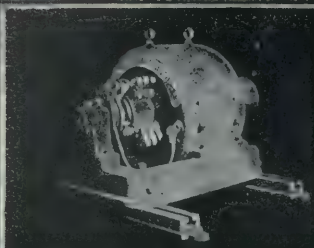
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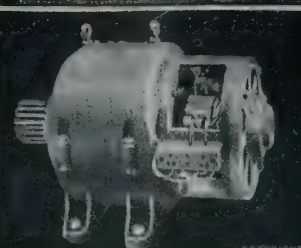
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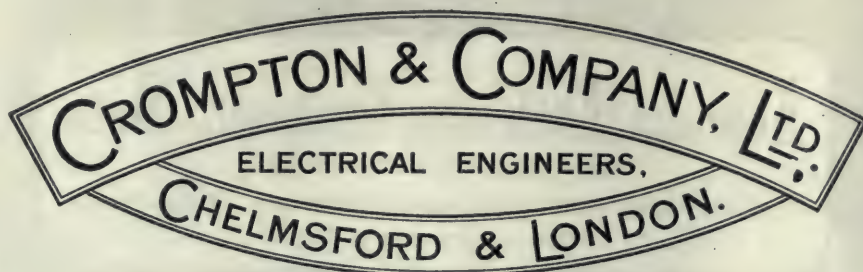
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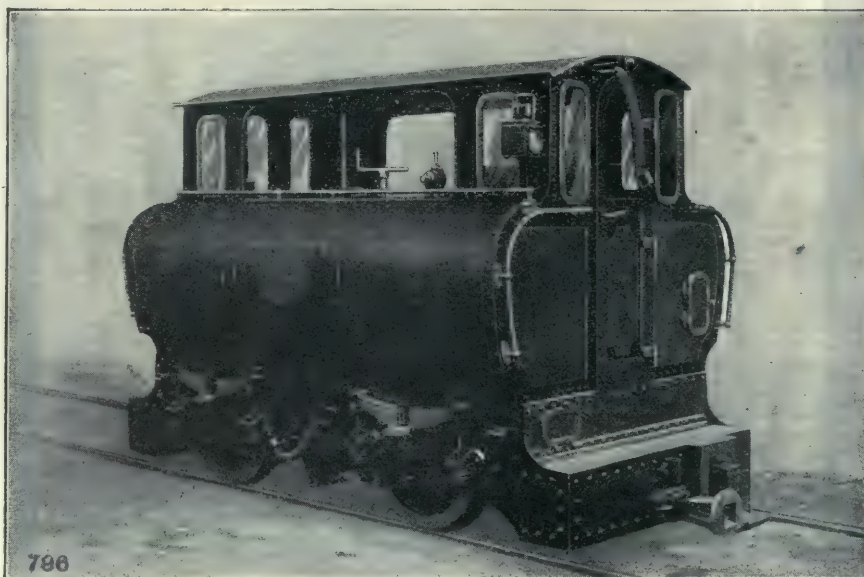
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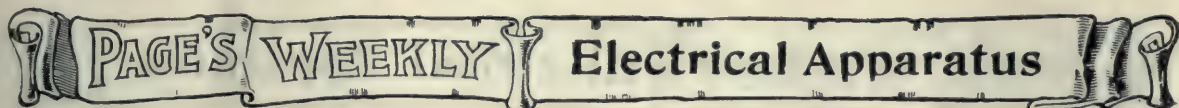
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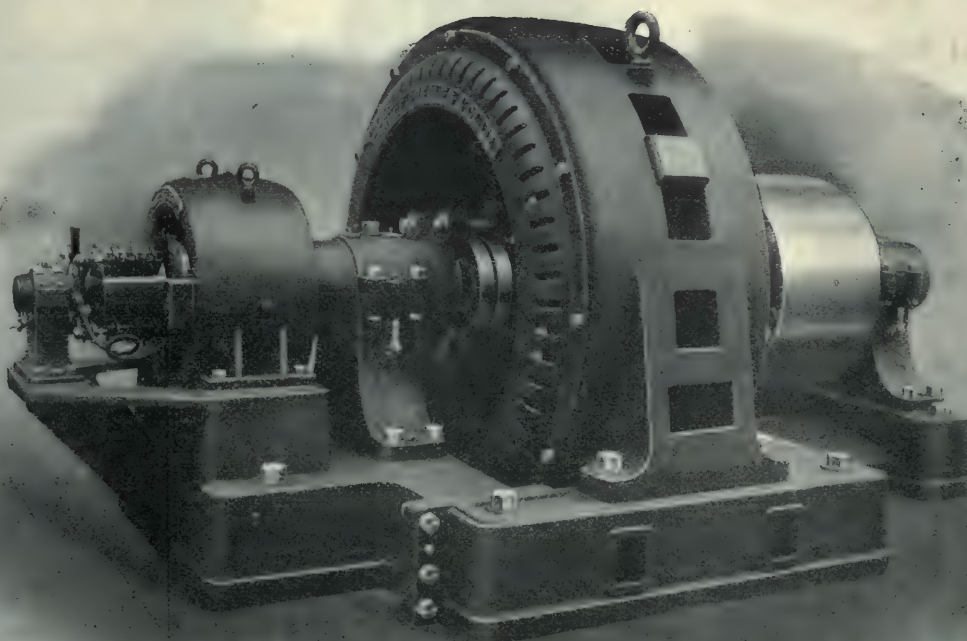


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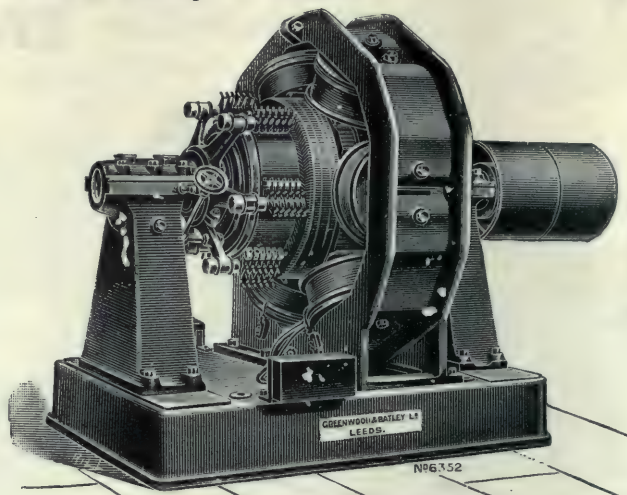
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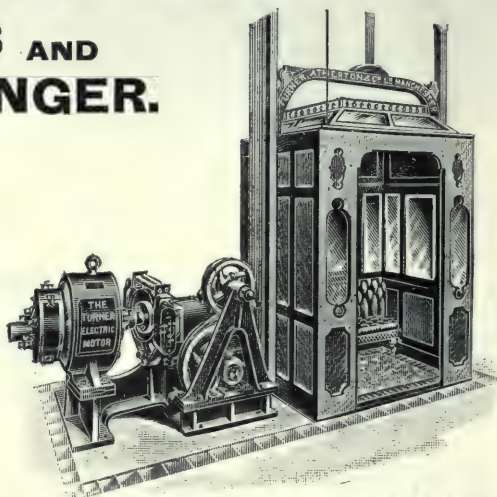
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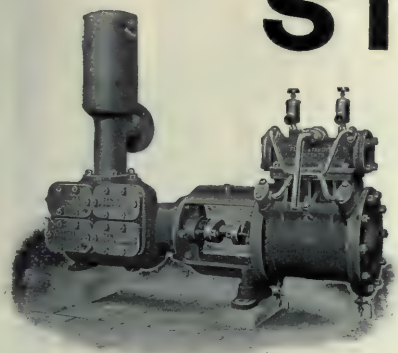
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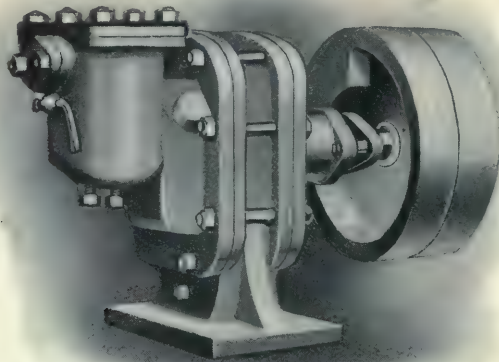
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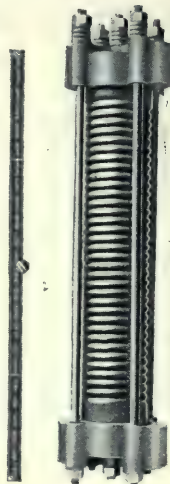


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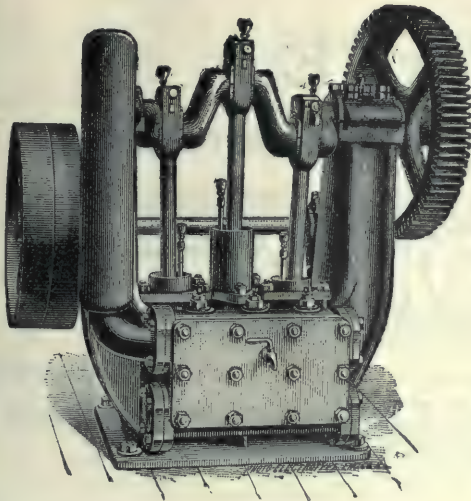


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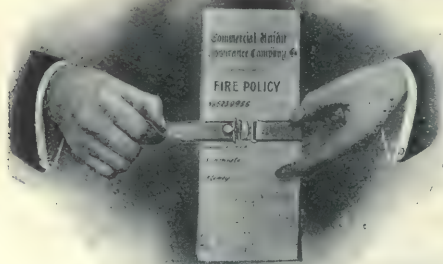
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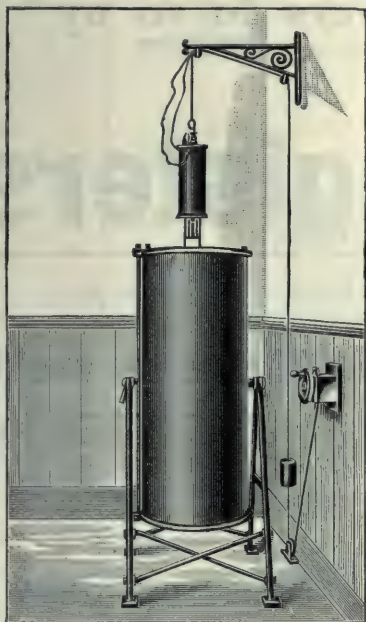
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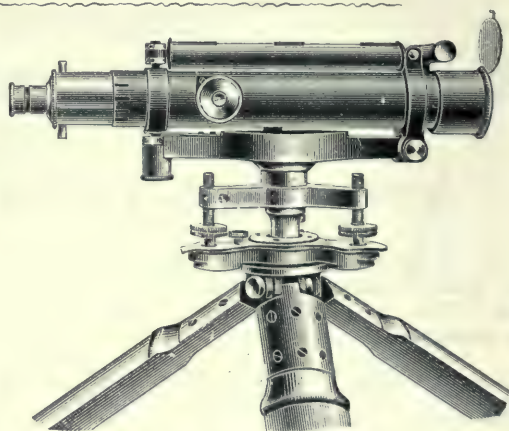
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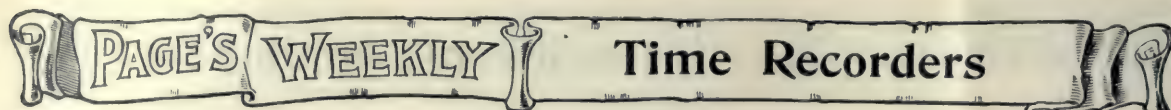


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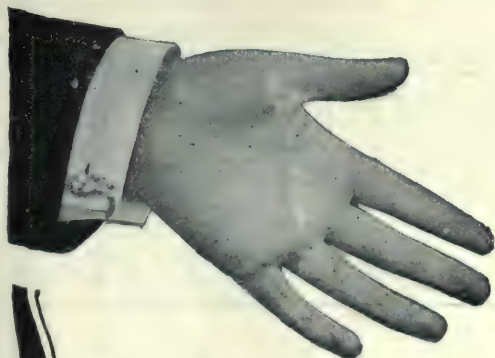
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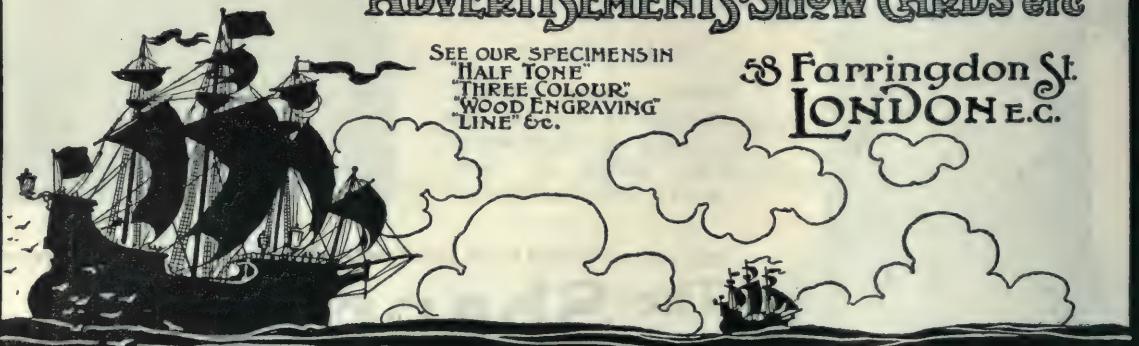
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DESCRIPTION																							
																		OVERTIME		TOTAL			
Sat.	7	30	11	9	30	10	30	11	30	12	30	2	30	3	30	4	30	5	30	6	30	7	30
Mon.	7		11	9		10		11		12		2		3		4		5		6		7	
Tues.	7		11	9		10		11		12		2		3		4		5		6		7	
Wed.	7		11	9		10		11		12		2		3		4		5		6		7	
Thur.	7		11	9		10		11		12		2		3		4		5		6		7	
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Remarks

It is distinctly agreed that
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(Sign)

Per.....

Address

Date

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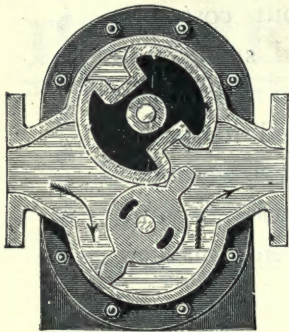
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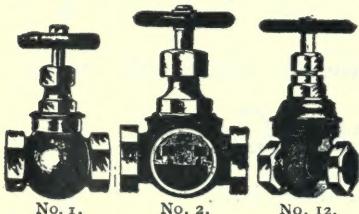
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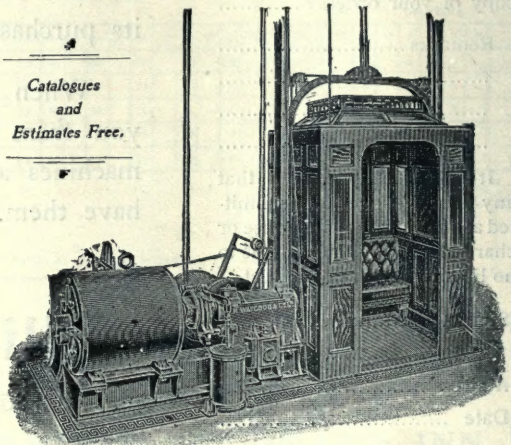
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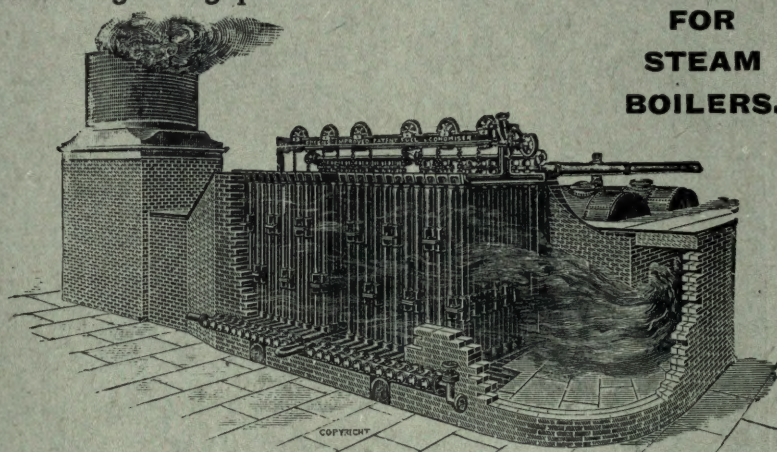
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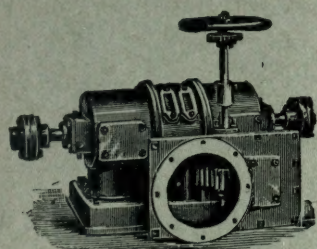
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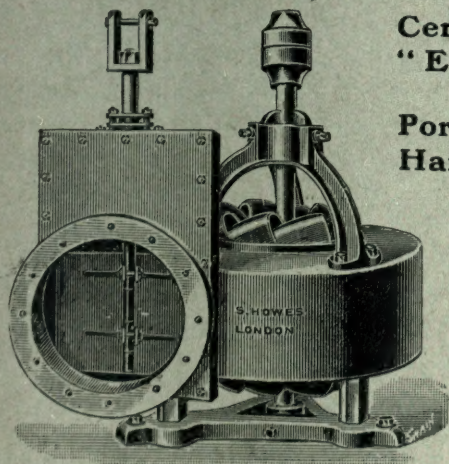
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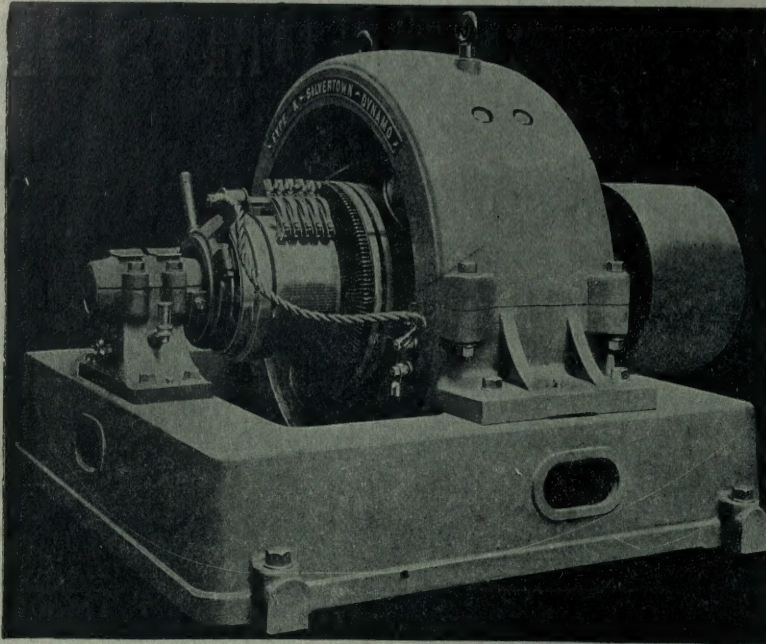
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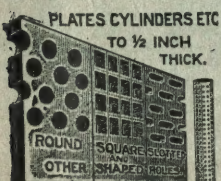
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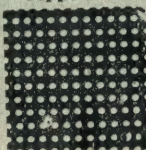
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